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# ***JPRS Report***

# **Science & Technology**

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***USSR: Chemistry***

18 AUGUST 1987

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## SCIENCE &amp; TECHNOLOGY

## USSR: CHEMISTRY

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COMMENT ON ARTICLE BY A. B. PODDOSKIN, A. A. YUSHKANOV AND YU. I. YALAMOV  
ON THERMOPHORESIS OF MODERATELY LARGE AEROSOL PARTICLES

Moscow KOLLOIDNYY ZHURNAL in Russian Vol 48, No 6, Nov Dec 86 pp 1220-1221

[Letter (originally submitted to ZHURNAL TEKHNIЧЕСКОY FIZIKI, which refused to publish it) by B.V. Deryagin, S.P. Bakanov and V.I. Roldygin]

[Abstract] In an article by V.I. Roldugin and S.P. Bakanov, "On Two Methods for Constructing a Theory on Thermophoresis of Large Aerosol Particles", published in KOLLOIDNYY ZHURNAL, Vol 39, 1977, p 1027, an expression was derived by two independent methods for thermophoresis velocity of bodies which takes into account first order corrections for small Knudson numbers. This was the first time there was full agreement of results by two approaches, which must be viewed as a significant success in the development of thermophoresis theories. However, the title article appeared in ZHURNAL TEKHNIЧЕСКОY FIZIKI, Vol 50, 1980, p 159 in which the authors maintained that the results obtained in the first work contradict existing experimental data, namely the observed growth in thermophoresis velocity of moderately large aerosol particles with increasing Knudson numbers, and that this discrepancy is due to two basic factors: 1) inadequate transition from the integral equation for entropy balance to a differential equation because the possibility of existence of non-hydrodynamic flow of entropy from the Knudson layer was neglected; 2) incomplete cognition of effects which are linear in Knudson number; specifically, the effect of slope on the rate of thermal slippage was neglected. These criticisms are disputed. Before any conclusions can be drawn on concurrence or lack thereof of experiment with theory, an experiment must be conducted where the coefficient of energy accommodation and tangential impulse are measured simultaneously with  $Kn = 0$  slope. Such data do not yet exist. Figure 1.

12765/9835

CSO: 1841/212

UDC 547.833.3+547.435

ISOQUINOLINE DERIVATIVES. PART 26. SYNTHESIS OF N-ARYLALKANOL DERIVATIVES OF 4-SPIROSUBSTITUTED 1,2,3,4-TETRAHYDROISOQUINOLINES (I) AND 1-(3',4'-DIMETHOXYPHENYL)-1-CYCLOALKYLMETHYLAMINES (II) WITH  $\beta$ -ADRENOBLOCKING PROPERTIES

Yerevan ARMYANSKIY KHIMICHESKIY ZHURNAL in Russian Vol 40, No 1, Jan 87  
(manuscript received 24 Jun 85) pp 40-44

[Article by G.K. Ayrapetyan, Zh.S. Arustamyan, O.S. Noravyan, K.Zh. Markaryan and E.A. Markaryan, Institute of Fine Organic Chemistry imeni A.L. Mndzhoyan, Armenian SSR Academy of Sciences, Yerevan]

[Abstract] Condensation reactions were conducted between 4-spirosubstituted I and II compounds and corresponding acyclic amines with m-nitrostyrene oxide and 3-phenoxy-1,2-epoxypropane to obtain the N-arylalkanol congeners. Ten target compounds were then tested on anesthetized rats and cats for adrenoblocking properties, resulting in the identification of three compounds deserving of further analysis. One of the compounds identified in this manner, 1-(3',4'-dimethoxyphenyl)-1-[N-(2''-hydroxy-3''-phenoxy)-propyl]-cyclopentylmethylamine blocked with the  $\beta_1$  and  $\beta_2$  adrenoreceptors. References 7 (Russian).

12172/9835  
CSO: 1841/323

LASER METHODS FOR SELECTIVE SPECTROSCOPY OF COMPLEX MOLECULES

Minsk SOVETSKAYA BELORUSSIYA in Russian 23 May 87 p 2

[Article by K. Solovyev, professor, laureate of the USSR and Belorussian SSR state prizes]

[Abstract] The author discusses laser methods which have been developed for studying the fine structure of spectra of complex molecules. The developers of these methods sought in particular to solve the problem of band broadening in molecular spectra and thus to obtain line spectra similar to those of atoms, the author explains. Methods involving supercooling of the substance and also introduction of molecules being studied into a crystalline medium were employed at first for this purpose. In certain types of media, however, uniform and non-uniform spreading of spectral bands prevents molecules which form impurity sites from radiating line spectra. This made spectral analysis of many substances impossible.

Capabilities of fine-structure spectroscopy have been substantially expanded by laser methods which scientists have developed for solving the problem of nonuniform spreading, the author relates. Associates of the USSR Academy of Sciences' Institute of Spectroscopy used the method of laser excitation of molecules to obtain line spectra which the earlier methods could not yield. The work was headed by R.I. Personov. Another method employs the phenomenon known as photo burning-out of gaps. Narrow gaps are formed in spread bands or absorption lines through the action of laser light at a certain wave frequency on the substance being studied. These gaps correspond to impurity sites whose oscillation frequency is in resonance with that of the laser radiation. The behavior of the gaps is similar to that of spectral lines.

The author recalls that experiments which led to development of the photo burning-out method were conducted by scientists of the Belorussian Academy of Sciences' Institute of Physics and their colleagues in Estonia. The combined group of scientists of Moscow, Leningrad, Estonia and Belorussia was awarded the 1986 USSR State Prize for the work-cycle entitled "Photo Burning-Out of Stable Spectral Gaps and Selective Spectroscopy of Complex Molecules".

The laser methods are said to open up new possibilities for studying physical chemical properties of molecules and interaction of substances with solvents, determining speeds of photochemical reactions, and analyzing complex mixtures. Photo burn-out of gaps is said to open broad prospects for developing optical storage devices for new generations of computers.

FTD/SNAP  
/9835  
CSO: 1841/378

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# EXPERIENCE IN USING AUGER-SPECTROSCOPY TO STUDY SURFACES OF VARIOUS MATERIALS AND INORGANIC DIELECTRICS

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 59, No 11, Nov 86  
(manuscript received 4 Jun 85) pp 2439-2448

[Article by V.Sh. Ivanov and I.A. Brytov, Leningrad Scientific-Production Association "Eurevestnik"]

[Abstract] Extensive experimental and theoretical research on surface phenomena is needed in order to have an understanding of corrosion processes, improve synthesis and material handling and to develop new catalysts. The modern scientific concept of a "solid body surface" is limited to that region of the body whose properties differ from those of the interior, i.e., a surface layer of one to ten atoms. This therefore entails an atomic-molecular approach. During the past five years instrumentation was developed which makes it possible to obtain reliable information on the element composition of a freshly made surface and to reconstruct its electronic structure. These methods rely on the results of the interaction of some sort of radiation with the surface layer of the solid body. One such method of diagnosis on the atomic-molecular level is the so-called electron Auger-spectroscopic method. As in local X-ray spectral analysis, element composition analysis is possible, but in contrast to the first method, this method allows analysis of the first 5-10 atom layer of a phase interface. The basis of data obtained by this method lies in the kinetic energies of Auger-electrons identically bound to the bond energies of internal and external atom shells, which makes it possible to use them to determine the chemical nature of surface elements. In the present work results are presented on the analyses of the surfaces of various materials including steel, carbon and dielectric materials. Figures 4; tables 2; references 17: 10 Russian, 7 Western.

12765/9835  
CSO: 1841/215

## CHROMATOGRAPHY: POTENTIAL AND ACHIEVEMENTS

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 5, May 87 pp 86-97

[Article by G.A. Grishin, candidate of chemical sciences, L.N. Kolomiyes, O.G. Larionov, doctor of chemical sciences, and L.A. Parenago]

[Abstract] Chromatography is used in many industrial and technical operations: production control, quality control, environmental protection, criminology, medicine, biology etc. There are many ways to classify chromatography: ion exchange, sorption, distribution, sieve; gas, liquid; analytical, preparative and technical; column and thin layer chromatography etc. A Scientific Council for Chromatography was organized at the USSR Academy of Sciences in 1968 to coordinate research activities in the field of chromatography. The Council consists of nine sections and five commissions; there are three regional branches. In 1985 the Fifth Danube International Symposium on Chromatography was held in Yalta and many references are made, in this paper, to that symposium. And yet, the authors complain about the fact that the USSR is far behind the USA in the area of production of equipment, in specialty journals and in the application of computers on-line with chromatographic apparatus: in fact the situation apparently gets worse with time (there still is not a single journal of chromatography published in the USSR). The remainder of the paper cited specific applications of analytical preparative and technical chromatographies. An appeal is made to include modern chromatographic technology in industrial, regulatory and research operations. Figures 4; references 2: 1 Russian, 1 Western.

7813/9835

CSO: 1841/390

## PROSPECTS FOR USE OF ELECTROCHEMICAL METHODS OF ANALYSIS IN PRODUCTION OF CHEMICAL FIBERS

Moscow KHIMICHESKIYE VOLOKNA in Russian No 2, Mar Apr 87 (manuscript received 23 May 86) pp 56-57

[Article by V.V. Bogoslovskiy, L.N. Bykova]

[Abstract] A study is made of electrochemical methods of analysis used in chemical-analytic testing of the production of chemical fibers, and their advantages are determined in comparison with other methods of analytic testing. Particular attention is given to the prospects for using electro-



chemical methods of analysis and their role in the creation of combinations of methods satisfying the requirements of modern production. The major trends are noted for future utilization of electrochemical methods of analysis in chemical-analytic monitoring of the production of chemical fibers. References 23 (Russian).

6508/9835

CSO: 1841/373

## CEMA MEMBER COUNTRIES COOPERATION

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 10,  
Oct 86 pp 73-74

[Article by Roman Buyanov, director of the Coordination Center, "Industrial Catalysts," corresponding member of the USSR Academy of Sciences: "Industrial Catalysts--An Urgent Sphere of Cooperation"; first two paragraphs are EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV introduction]

[Text] It is impossible to conceive of modern chemistry without catalysts. Over 75 percent of industrial chemical processes are catalytic, and their proportion among the new ones is over 90 percent. Increasing the activeness and the selectivity of catalysts is making it possible, with the least capital input, to improve the technological indicators of the processes [productivity of the unit, consumption of raw material, energy, etc.]. Therefore, work on improving catalysts is being carried out throughout the world; at the present time the field of catalysts is one of the most science-intensive.

In the future the use of catalysts will go far beyond the bounds of traditional chemical technology. For example, there are broad potentials being opened for catalytic methods of solving ecological problems related to the neutralization of sewage waters, industrial and transport emissions; catalysts can aid in implementing optimal variants for fuel combustion and efficient processes for drying porous materials. Success in fulfilling the assignments for polymers, specified in the section, "New Materials and the Technology of Their Production and Processing," of the Comprehensive Program for Scientific-Technical Progress in the CEMA Member Countries up to the Year 2000, depends to a considerable extent on providing the appropriate catalysts.

Industrial catalysts are among the most important national economic problems being solved by using the most efficient forms of international cooperation. In 1971, a Coordination Center (KOTs) was organized for the problem, "Developing New Industrial Catalysts and Improving the Quality of the Catalysts Being Used in Industry." At present, KOTs is consolidating the work of 60 organizations in 9 socialist countries: The People's Republic of Bulgaria, the Hungarian People's Republic, the German Democratic Republic, the Polish People's Republic, the Republic of Cuba, the Socialist Republic of Romania, the USSR, the Czechoslovak Socialist Republic and the Socialist Federated Republic of Yugoslavia. As a result of the cooperation, the assortment of industrial

catalysts being produced in the countries participating in the agreement on the problem is being constantly updated and expanded. Catalysts such as IK-1-6, for sulfuric acid production (USSR), palladium catalysts for selective hydrogenation (GDR) and nickel catalysts for conversion of natural gas, NC-2S (People's Republic of Romania) are among the best modern analogies.<sup>1</sup> The Council of Delegates is faced with the task of organizing collaboration, not only with respect to the development of catalysts, but also their industrial production, specialization and cooperation.

Reciprocal supplies in accordance with bilateral agreements form the bases of this work. Catalysts are supplied either as an independent product, or in a set with the appropriate equipment. For example, the Polish People's Republic, specializing in the output of equipment for sulfuric acid production, at the same time provides the catalyst for the first charging of the reactor; the People's Republic of Bulgaria supplies automatic loaders in a set with a catalytic system for gas purification; catalysts from the USSR and the GDR are at work in many CEMA member countries. Experience in such supply has made it possible to evaluate objectively the quality of the product manufactured and to give recommendations on its use for various types of units and raw material. The growth of the countries' demand for catalysts--both in volume and assortment--makes the problem of multilateral specialization in their production a pressing one. This requires a qualitatively new level of economic relations among the countries and consolidation of the long-term nature of the partnership. At the same time, the product manufacturer is obliged to ensure the high quality of the specialized product and its constant improvement and updating in accordance with world trends.

In the opinion of the Council of Delegates, it is inexpedient to produce all the necessary catalysts in all the countries, but it is also inefficient to concentrate their output in one country alone. It appears that the optimal variant is that in which the product is manufactured in two or three countries. This ensures a spirit of competition in achieving high quality for the specialized product and service in the supply.

International multilateral specialization in the production of catalysts began with the output of a group of catalysts for the oil refining industry. In 1981, within the framework of the Internefteprodukt MKhT [International Economic Partnership], a multilateral agreement was signed (People's Republic of Bulgaria, Hungarian People's Republic, German Democratic Republic, Polish People's Republic, Republic of Cuba, USSR and Czechoslovak Socialist Republic), which determined specialization in the output of catalysts for cracking, reforming and isomerization of gasolines, hydrorefining and hydrocracking. In discussing the expansion of the products list of catalysts, the Council of Delegates came to the conclusion that, on the basis of the capacities existing in the countries, it was impossible to fully satisfy their demand for catalysts, considering the prospects for development of the basic chemical production facilities. The need to construct a specialized enterprise, in order to maximally reduce imports from the capitalist countries, replace the generations of catalysts and quickly utilize developments new in principle, was substantiated.

For the present, a General Agreement on Specialization in the Production of Catalysts has been prepared on the basis of setting up a new capacity in the USSR. At the same time, the long-term specialization of the USSR according to a coordinated products list assumes cooperation from the Hungarian side in supplies of aluminum oxide carriers for a number of catalysts. The Coordination Center has already accumulated some experience in organizing this work. An example of this is the multilateral agreement (People's Republic of Bulgaria, Hungarian People's Republic, GDR and USSR) on developing a new type of catalysts for the conversion of natural gas, using Hungarian carriers. The Hungarian side is developing and manufacturing the carriers in accordance with the technical requirements of the partners, who in the future plan to produce industrial samples in cooperation with the Hungarian People's Republic, specializing in commercial supplies of the carriers for the newly created catalysts.

The Council of Delegates is examining the construction of the specialized enterprise, not only as the solution to the problem of providing the countries with industrial catalysts, but also as a new basis for scientific-technical cooperation. In the opinion of the representatives of the sides in the Council, creating a modern enterprise for catalyst production sets up the actual conditions for efficient division of labor during the fulfillment of scientific research work related to the improvement of catalysts.

The basic content of the program for scientific-technical cooperation up to 1990 is oriented toward improving the catalysts included in the products list of the enterprise. The program is being formed today on the basis of combined forecasting materials which evaluate the prospects for developing new catalytic processes in the countries.

Footnote 1. See: EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV, No 8, 1982

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## YOUNG SCIENTISTS EMERGE AS DOMINANT FORCE IN COMPUTER AND CHEMISTRY R&D

Moscow TRUD in Russian 19 Apr 87, p 2

[Article by S. Kabanikhin, candidate of physical-mathematical sciences, chairman of the Council of Young Scientists of the USSR Academy of Sciences' Siberian Department]

[Excerpts] A young people's inter-institute council for the use of computer technology was created four years ago in the Council of Young Scientists of the USSR Academy of Sciences' Siberian Department. With much enthusiasm and knowledge of their work, Candidate of Physical-Mathematical Sciences A. Kovalkov, chairman of the inter-institute council, and all of its members began creating a flexible exchange fund of algorithms and programs, and they organized an extensive cycle of lectures and seminars on questions of the application of computer technology. Last year, they organized an All-Union scientific conference at the Siberian Department of the Academy of Sciences.

Interbranch scientific-technical complexes (MNTK) are the most important and promising form for introducing scientific development, in my opinion. One of these complexes, "Katalizator" (catalyst), has been created at the academy's Siberian Branch. New possibilities have appeared for rapid advancement of young people who are energetic and talented. On Friday, I talked by telephone with I. Zolotarskiy, chairman of the council of young scientists of the Siberian Department Institute of Catalysis. He headed the organizing committee of a conference of young scientists and associates of "Katalizator" which had ended that day in Academy City. At that conference the decision was made to create a joint council of young scientists and specialists of institutes and enterprises belonging to the MNTK.

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PHYSICAL, CHEMICAL AND CATALYTIC PROPERTIES OF MIXED OXIDES OF SYSTEM  
 $\text{La}_{2-x}\text{Sr}_x\text{Cu}_{1-y}\text{Cr}_y\text{O}_4$  IN REACTIONS OF CARBON MONOXIDE OXIDATION

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 59, No 11, Nov 86  
(manuscript received 24 Jun 85) pp 2409-2413

[Article by V.S. Komarov, V.I. Varlamov and M.A. Shlyk, Institute of General and Inorganic Chemistry, BSSR Academy of Sciences]

[Abstract] A study was made of the physical, chemical and catalytic properties of the title system mixed oxides where  $x = 0.2-0.8$  and  $y = 0.1-0.4$  in carbon monoxide oxidation reactions. The samples were prepared by precipitation from nitrate solutions with ammonium oxalate, heating to 400 deg and calcining at 800, 950 and 1100 deg for 4 hours. A high catalytic activity was observed in lanthanoid cuprites for redox reactions of methanol and carbon monoxide oxidation and nitrous oxide reduction reactions. Lanthanum cuprite has a structure similar to that of perovskite,  $\text{K}_2\text{NiF}_4$ , with an ortho-rhombic distortion. Lanthanum chromite has a similar structure. It is also known that chromites of rare earth elements having perovskite structure have extremely high stability to 2200 deg, although their catalytic activity is less than that of the double oxides of lanthanum with other transition metals. It may be proposed that by substituting a certain quantity of copper ions with chromium in lanthanum cuprite it will be possible to obtain samples having high heat resistance with sufficiently high catalytic activity. Figures 2; references 8: 2 Russian, 5 Western.

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OXIDATION OF PROPYLENE WITH HYDROGEN PEROXIDE IN PRESENCE OF  $\text{PPFe}^{3+} \cdot \text{OH} / \alpha\text{-Al}_2\text{O}_3$  (ANALOG OF CYTOCHROME P-450)

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA 2, KHIMIYA in Russian  
Vol 27, No 6, Nov Dec 86 (manuscript received 25 Sep 85) pp 564-567

[Article by T.M. Nagiyev, Z.M. Nagiyeva and Sh.A. Tagiyeva, Institute of Theoretical Problems in Chemical Engineering, Baku]

[Abstract] Hydroxylating enzyme systems, particularly cytochrome P-450 and its analogs, are capable of promoting substrate oxidation under mild conditions, but the development of new catalytic systems imitating cytochrome P-450 is fraught with difficulties. Organic hydroperoxides used to oxidize organic substrates in the presence of cytochrome P-450 analogs have advantages over using molecular oxygen as a mono-oxy-generating agent, although the ROOH groups themselves have additional factors which affect the selectivity of the process. Using hydrogen peroxide in place of ROOH should be an improvement because it decomposes into water and oxygen, which are relatively inert, while ROOH decomposes into alcohols, ketones etc. Hydrogen peroxide is also capable of initiating selective oxidation of the substrate. In the present work an attempt was made to develop a catalytic system of selective and regio-selective oxidation which combines the specific features of hydrogen peroxide oxidation with that of a metal-porphyrin on an aluminum oxide carrier. Gas-conditions for 60% yield by weight are 160 deg and 1:1 molar ratio of propylene to hydrogen peroxide at 1.9 sec contact time. Figures 4; references 11 (Russian).

12765/9835  
CSO: 1841/235

CONFERENCE ON HEAT-RESISTANT COATINGS

Leningrad LENINGRADSKAYA PRAVDA in Russian 15 Apr 87 p 3

[Excerpt] Protective coatings are used widely to prolong the life of various materials. Their development and applications are the subject of an All-Union conference on heat-resistant coatings which opened yesterday at the USSR Academy of Sciences' Institute of Macromolecular Compounds. The conference is sponsored by the USSR Academy of Sciences, the USSR State Committee for Science and Technology, the USSR Academy of Sciences' Inter-agency Coordinating Council in Leningrad, and the Leningrad branch of the All-Union Chemical Society imeni Mendelyev.

In papers and reports, representatives of leading research and industrial centers of the country are focusing attention on means of protecting equipment of chemical and ore-processing plants, thermal electric power stations, and gas-pumping equipment. They are discussing prospects for the reliable operation of equipment in extremely corrosive environments, and they are analyzing a new form of integration of science and industry within the framework of the interbranch scientific-technical complex "Antikor".

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UDC 622.765:661.185

STABILIZATION OF INTERFACIAL FILM WITH DYNAMIC ADSORPTION LAYER OF SURFACTANT  
DURING FUNDAMENTAL ACT OF FLOTATION

Moscow KOLLOIDNYY ZHURNAL in Russian Vol 48, No 6, Nov Dec 86  
(manuscript received 27 Dec 84) pp 1184-1189

[Article by A.V. Listovnichiy and S.S. Dukhin, Institute of Colloid  
Chemistry and Water Chemistry, UkSSR Academy of Sciences, Kiev]

[Abstract] The dynamic absorption layer of a surfactant on an emerging bubble during a flotation process can have a significant effect on the flow of the process. The adsorbed surfactant molecules are carried into the feed zone of the bubble, while the magnitude of adsorption increases along the direction of surface movement, i.e., from the zenith to the nadir of the bubble. A particle, thus being displaced along the surface of a bubble, enters into a region of higher adsorption values, i.e., the adsorption magnitude of the surfactant on the external side of the interfacial film steadily increases. As a result, adsorption in the center of the film becomes less than that of the periphery, and surface tension thus increases from the periphery towards the center. This causes liquid to flow into the space between the particle and the bubble while generating non-equilibrium surface forces which prevent the film from becoming thinner. In the present work this theory is further generalized by examining the stabilization of the interfacial film by a dynamic adsorption layer of an emerging bubble. Results obtained in a previous work on this effect on the flotation of a weakly inhibited surface are generalized for the case of random hydrodynamic streamlining of a bubble. Figures 2; references 8: 6 Russian, 2 Western.

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## MARINE PLANT MATTER AS INHIBITOR OF METAL CORROSION

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 59, No 11, Nov 86

(manuscript received 4 May 85) pp 2559-2560

[Article by G.M. Popelyukh and L.I. Talavira, Physical Chemical Institute imeni A.V. Bogatskiy]

[Abstract] Natural materials of plant origin, especially marine algae, are high in surface active properties. In the present work a study was made of the corrosion inhibiting properties of an extract obtained as a by-product of treating White Sea Fucus algae Residue from conversion of Fucus to sodium alginate was hydrolyzed for 4 hours in 3% hydrochloric acid on a water bath. After neutralization with NaOH and evaporation, a product was obtained having 45% organic matter, 40% mineral matter and 15% moisture. The organic matter contained amine, hydroxyl and carboxylic acid groups with 3% protein compounds and 15% reducing sugars. Mineral matter consisted of calcium and sodium chlorides, the latter being the product resulting from neutralization of the hydrolyzate. Corrosion tests were conducted gravimetrically on St. 3 steel samples coated with the extract by immersion in 10-50% sulfuric, hydrochloric and phosphoric acids, and 0.5-2.0% sodium hydroxide. The data show that the extract effectively inhibits both acid and alkaline corrosion. The coefficient of corrosion inhibition for 10% HCl at 85 deg increased 5 times after addition of 0.1% urotropin. The Fucus inhibitor was shown to be as effective as industrial inhibitors BA-6, katapin K and I-1-V against 20% sulfuric acid, with practically no decrease in effectiveness after 200 hours. The tests demonstrate that the extracts may be used as corrosion inhibitors for low alloy steels and certain aluminum alloys, such as DIAM. Figures 3; references 5: 3 Russian, 2 Western.

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## PLASMID DETERMINATION OF BREAKDOWN OF ANIONIC SURFACTANTS

Kiev KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 9, No 12, Mar Apr 87  
(manuscript received 12 Jun 86) pp 165-167

[Article by L.F. Ovcharov and M.N. Rotmistrov, Institute of Colloid Chemistry and Water Chemistry imeni M.V. Dumanskiy, UkSSR Academy of Sciences, Kiev]

[Abstract] The breakdown of synthetic organic compounds by microorganisms is controlled by intrachromosomal genetic elements: the plasmids. A large number of biodegradation plasmids (D-plasmids) was isolated. Localization of the biodegradation genes should make it possible to combine, in one bacterial cell, genetic material controlling formation of destructive enzymes for several xenobiotics. A series of anionic surface active agent destructors was evaluated showing that destruction of vulgonate in the strain *P. rathonis* T is controlled by vulgonate destruction plasmid pDX1; destruction of metaupone in the strain *P. putida* K,--by metaupone destruction plasmid pDX2 and the destruction of ethoxylates in strain *P. putida* G, by sulfoethoxylate destruction plasmid pDX3. References 10: 3 Russian, 7 Western.

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UDC 637.1:66.067.38

## PROSPECTS FOR DEVELOPMENT OF MEMBRANE TECHNOLOGIES

Moscow MOLOCHNAYA PROMYSHLENNOST in Russian No 5, May 87 pp 8-10

[Unsigned article derived from documents of the Scientific-Technical Council of the USSR State Agro-Industry]

[Abstract] Membrane technology for the production of dairy products is best used where it can significantly increase the output of dairy products per unit of milk processed or decrease power consumption. The basic tasks have been defined for the 12th Five-Year Plan in the area of utilization of membrane processes in the dairy industry, creation of high productivity equipment, semipermeable and ion-selective membranes for ultrafiltration and diafiltration, reverse osmosis and electrodialysis. Areas of application of membrane technology planned for the USSR are listed and briefly discussed. The planned rate of usage will require the introduction of over 90 complex, highly-mechanized and automated production lines equipped with ultrafiltration installations with capacities of 10 tons per hour, 200 reverse osmosis and 26 electrodialysis installations of the same productivity.

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CSO: 1841/360

ADHESIVE INTERACTION OF THIN POLYAMIDE FILMS AND METALS

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA KHIMICHNYKH NAVUK in Russian No 1, Jan Feb 87 (manuscript received 3 Jan 85) pp 45-50

[Article by S.S. Pesetskiy, O.N. Aleksandrova and S.V. Shcherbakov, Institute of Mechanics of Polymer-Metal Systems, BSSR Academy of Sciences]

[Abstract] A study of thermal adhesive interaction of 0.9-1.0  $\mu\text{m}$  thick P548 film and 08CP steel, Cu, Ni, Al, Ti, Zn and Au is described and discussed. The adhesive strength of compounds of the films was determined, basically, by the relationship of destructive-cross-linking processes occurring within them at the stage of thermal contact with the metals in air. The surfaces of Cu and 08CP steels were effective catalysts of thermo-oxidative cross-linking of the polyamide macromolecules. The adhesion bond of the oxidized macromolecules with the metal (except in the case of Au) was realized via oxygen, chemisorbed by the metal surface. Figures 2; references 10: 9 Russian, 1 Western.

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ANALYSIS OF DATA ADEQUACY IN AUTOMATED PROCESS CONTROL SYSTEMS FOR CHEMICAL PRODUCTION

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, Apr 87 pp 1-2

[Article by B. Kh. Kirshteyn, candidate in technical sciences, and N. V. Roginskiy, engineer, under the rubric "Automated Control Systems": "Analysis of Data Adequacy in Automated Process Control Systems for Chemical Production"]

[Text] Over the course of several years the TsNIIKA [State All-Union Central Scientific Research Institute for Integrated Automation] (Moscow) has been developing and introducing an ASUTP [automated process control system] for the "Azot" high-unit-capacity ammonia plant (later modifications "Azot-T," "Azot-M").

As the functions of these systems expand, ensuring the reliability of the data processed in the system is becoming an increasingly important problem. Control function automation is unthinkable unless the process conditions at the site can be replicated by identical sets of measurable or calculable parameters which describe these conditions.

In addition, several objectively significant factors prevent such replicability by purely engineering equipment. The peculiarity of the functioning of large plants in certain cases hinders efficient correction of even obvious instrumentation malfunctions, not to mention a constant factor such as the drift in measuring channel characteristics. But even if measuring devices input data into the ASUTP within the limits of the corresponding accuracy classes, the results of the computer processing of these data may turn out to be unreliable. The fact is that, when indicators are calculated, it is very important to account for all factors which affect the given parameter being calculated, and we must limit ourselves to characteristics which provide normal (design) operating conditions.

A simple example. The position of a discharge valve past a gauge, which should be strictly recorded under standard (normal) operating conditions, periodically varies if the process situation becomes complicated. Naturally, this distorts the actual gas flow rate calculated with regard for the valve's standard position.

As a rule, however, the entire complicated set of factors leading to distortion and data unreliability acts simultaneously. At any point in time only a comparatively small portion of the data is unreliable. This has permitted development and introduction of algorithms which, in several cases, make it possible to detect unreliable values and introduce the necessary corrections. The fact that certain measurable and calculable values are related by functions which are sufficiently approximated by linear relations, is used.

Reliability may be monitored, unreliable values detected, and required corrections introduced under idealized conditions -- in which there are no measuring errors and the model's relations are precisely satisfied -- by well known methods [1, 2], which in general amount to the following.

Let us consider a static model like

$$Ax=0 \quad (1)$$

where  $x$  is the vector of the values analyzed;  $A$ , the  $(n \times m)$ -matrix of connections.

After eliminating some of the variables from equation (1), we derive ratios, the different groups of which will contain different measurable parameters. Let us substitute the parameters to be analyzed into the resulting expanded system. The relations which do not contain unreliable values will be fulfilled; the rest will be destroyed. After analyzing the makeup of variables included in different groups, one can identify unreliable values. For example, after consecutively eliminating variables  $x_1, \dots, x_n$  from two equations  $a_{11}x_1 + \dots + a_{1n}x_n = 0$ ;  $a_{21}x_1 + \dots + a_{2n}x_n = 0$ , we can identify the unreliability of parameter  $x_k$ , if all equations which do not contain  $x_k$  are satisfied, while those that contain it are not.

This method has certain deficiencies, however. First, the number of additional relations required to identify different probable groups of unreliable values may turn out to be very large, while methods for deriving all these relations are rather complicated [3]. Second and more important, idealization is not assumed in a real-life situation, measurable and calculable values contain certain errors, and instead of relations (1) one must consider more the realistic relations:

$$|Ax| \leq \epsilon, \quad (2)$$

where  $\epsilon$  is the vector for threshold values for permissible discrepancies in relations (1).

If this model is used, the appearance of unreliable values may not be detectable on the background of normal measurements and, just the opposite, the overall effect of normal measuring errors may be classified as unreliability in one measurement.

Therefore, methods which consider the possible appearance of mutually compensating or ambiguously expressed distortions in information processed in

the ASUTP configured with rather economical computer equipment must be developed to analyze unreliability.

/This article considers a method for analyzing information reliability/ based on an approach which in a certain sense is ambivalent in relation to what has been said so far. The essence of the method amounts to the following.

A vector  $v$  for corrections which solve the system of inequalities

$$|A(x+v)| \leq \epsilon, \quad (3)$$

and such that the number of non-zero components in vector  $v$  whose values exceed certain preset boundaries is minimum is sought.

Solving this problem permits more detailed analysis of the reliability of information, and, in several cases when unreliable values have been identified, simultaneous evaluation of the magnitude of the required correction is made.

The following definition has been introduced for a more strict and precise description of the proposed approach. Let us call the maximum number  $r$  of distorted components of an arbitrary solution to system (1) identified on the basis of matrix  $A$  the /potential restoration factor/.

To ensure potential restoration multiple  $r$ , we must have a matrix  $A$  with at least  $r+1$  lines [1]. This condition is not sufficient, and for certain matrices  $A$  with any number of lines one cannot identify even a single unreliable value. Therefore, determining its potential restoration multiple in terms of matrix  $A$  is an important problem to be solved at the design stage of development [4]. In the case of a model like (2), situations arise when one cannot explicitly identify unreliable values for any potential restoration factor for matrix  $A$ .

These situations, called variable, also require special study,, and the approach being described permits this.

Two basic factors lead to variability. 1. The number of unreliable parameters exceeds the potential restoration multiple. As a rule, this happens in an abnormal situation in the object which requires leaving the steady-state rated operating mode. 2. Values of distorted measurement results or of calculations are insufficient for explicit identification of unreliable values. In the first case, algorithms whose use is geared toward standard mode must be suppressed. In the second case, observation time must be increased to clarify the developing situation.

Reliability is analyzed using reference boundaries for correction values determined as follows:

$$a_i = 2 \sum_{j=1}^n c_{ij} \epsilon_j, \quad (4)$$

here  $c_{ij}$  is defined as the maximum value of the efficiency function in the mathematical programming task  $\max |x_i|$  if

$$Ax = \delta_j, \quad (5)$$

where  $\delta_j$  is the vector column whose  $j$ -th component equals 1, while the rest equal 0.

The most time-consuming operations -- determining the values of  $c_{ij}$  and the potential restoration multiple -- are performed at the design stage of development.

The proposed procedure for analyzing reliability consists of the following.

If relations (2) are satisfied when the values to be analyzed are substituted, i.e., system (3) has a solution with a zero correction vector, then the initial values are reliable. If relations (2) are not satisfied and system (3) may be solved with conditions for correction

$$|v_i| \leq a_i, \quad i = 1, \dots, n, \quad (6)$$

then unreliable values are not explicitly identified (type 2 variability), but all information may be corrected within the framework of the preset variation boundaries.

If relations (2) are not satisfied and system (3) has no solutions which satisfy conditions (6), but there is a solution for the corrections whose nonzero components do not exceed the magnitude of the potential restoration multiple, unreliable values are explicitly identified and the required corrections are evaluated.

Finally, the remaining possibility -- that the number of corrections exceeds the potential restoration multiple and among them are some which have rather large values -- corresponds to the first type of variability, i.e., the number of unreliable values is too large for explicit identification.

Thus, one may recommend the following procedure for applying this technique during design and use of devices to analyze reliability in chemical processing ASUTP.

Since the parameters which are most cumbersome to derive (matrix  $A$ , potential restoration multiple  $r$ , factors  $\alpha_i, c_{ij}$ ) are not a function of a specific set of measurable or calculable values, they must be determined at the design stage of development using well known or specially developed devices which solve the mathematical programming problems indicated above.

The task of analyzing the compatibility of systems of inequalities (2), (3), and (6) or, if all these systems are incompatible, the task of solving system (3) with the condition that the number of nonzero components of vector  $v$  is minimum must be solved at the operating stage.

All these problems are solved by standard linear and bilinear programming devices [5].



Depending on the results of their solution, either the reliability of the analyzed values or the inability to identify unreliable values because they cannot be explicitly identified on the background of normal errors or because the number of unreliable values is too large is determined, or, finally, unreliable values are identified and the required corrections are evaluated. Besides their direct purpose, the results of this analysis may be used in the general algorithm for system operation, depending on the problems posed.

Algorithms developed on the basis of this method are being introduced on one of the plants. Their test operation has shown that even use of simplified aggregate functions is sufficiently effective when the technique developed is used.

The possibility of identifying data distortion which does not exceed the boundaries of regulation and of immediate restoration of reliable values has been confirmed.

The capacity for automated recording of unreliable values has turned out to be important from the users' standpoint.

Use of the devices developed allowed the completeness and reliability of information on the production process to be increased and also ensures a reliable base for further expansion of ASUTP functions.

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## CEMA-YUGOSLAV COLLABORATION IN CHEMISTRY

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 10,  
Oct 86 pp 82-88

[Article by Gyunter Vishovski, minister of the Chemical Industry of the German Democratic Republic, chairman of the CEMA Standing Commission on Collaboration in the Chemical Industry: "Thirty Years of Collaboration Between the CEMA Member Countries and the Socialist Federated Republic of Yugoslavia in the Field of Chemistry"]

[Text] In 1986 the CEMA Standing Commission on Collaboration in the Chemical Industry (Commission) marked the 30th anniversary of its activity. It is safe to say that these were years of further intensification of the economic integration of the fraternal countries. On the basis of international socialist division of labor, the production sectors and subsectors that determine scientific and technical progress in the national economy of these countries, including the chemical industry, developed at rapid rates.

### On the Paths of Collaboration and Integration

In 1951-1985, the proportion of this sector, including petroleum refining, increased from 2.4-5.6 to 3.3-16.8 percent, and in countries such as the People's Republic of Bulgaria, the Hungarian People's Republic, the GDR and the CSSR, it provides over 15 percent of the total volume of industrial output. With respect to this indicator they were equal to economically developed capitalist states.

The growth in the output of chemicals is accompanied by advanced structural improvements in the sector. The production of chemicals for agricultural needs--mineral fertilizers, chemical pesticides, biochemical fodder additives--as well as chemical fibers, plastics, synthetic resins and rubber--developed at outstripping rates.

Some 34.4 percent of the world production of mineral fertilizers, as against 20.5 percent in 1950, fell to the share of the CEMA member countries in 1985. Estimated per capita, more fertilizer is produced in the CEMA member countries than in such industrially developed countries as Great Britain, Italy and Japan.



In 1985, as compared with 1950, in the countries of the socialist commonwealth production of chemical fibers rose by a factor of 14.5 and constituted 2.5 million tons. The output of plastics reached approximately 8.3 million tons, which is greater than in 1960 by a factor of 15.4.

Collaboration within the framework of our Commission plays a considerable role in this advance of the chemical industry. In the initial period of activity it organized exchange of experience among the countries, coordination of scientific research work and transmission of scientific-technical information and documentation, and created the prerequisites for the development of reciprocal commodity exchange. The Commission deserves great credit for coordinating plans for the development of the chemical industry up to 1960, and then to 1965, in the course of which reciprocal commodity supply was coordinated. This contributed to the formulation of national plans and to the establishment of intersectorial proportions, in consideration of the interests of other countries.

Initially, the seven work groups were engaged in organizing collaboration in the main spheres of the chemical industry, but beginning in 1958 the Commission was entrusted with additional functions connected with the abolishing of the Standing Commission on Timber and Cellulose. In the following years, to solve the multisectorial problems of collaboration in the chemical, paper and pulp and microbiological industries, 29 permanent operations organs, including 16 work groups, 11 scientific-technical councils and two directorial conferences were formed, and functioned up to 1979. In 1969, on proposals from the Commission, the Interkhim MEO [International Economic Association] was created (in residence in the GDR, Galle/Zaale), called upon for interaction in the sphere of low-tonnage chemistry. In 1979, upon the recommendations of the Commission, the Interkhimvolokno International Economic Organization was formed (in residence in the Socialist Republic of Romania, Bucharest). These MEO to a certain extent freed the Commission from solving problems in the fields indicated, but the Commission carries out the general guidance and supervision of their work.

As the years passed, the collaboration of the fraternal countries became more intensified, and the circle of participants in the Commission grew larger. While at the beginning of its activity, seven countries were represented here--the People's Republic of Bulgaria, the Hungarian People's Republic, the German Democratic Republic, the Polish People's Republic, the Socialist Republic of Romania, the USSR and the CSSR--there are now 11 countries. Beginning in 1964 the Socialist Federated Republic of Yugoslavia has been participating in the work of the Commission, in 1972--the Republic of Cuba and in 1978--the Mongolian People's Republic and the Socialist Republic of Vietnam.

The Comprehensive Program for Further Intensification and Improvement of Collaboration and Development of the Socialist Economic Integration of the CEMA Member Countries was particularly important for a further rise in the chemical industry. Along with such important problems as providing the chemical and paper and pulp industries with the necessary types of raw material, and the national economy as a whole--with polymers, mineral fertilizers, chemical and biochemical feed additives, dyes, intermediate products, cellulose, paper and household chemistry items, this Comprehensive Program contained a large number

of other problems solved by the Commission. They were primarily aimed at the production of new chemical products, on a petrochemical base, and the introduction of advanced technology and highly productive types of equipment with a high degree of automation. The production volume of the chemical industry of the CEMA member countries has increased by a factor of 2.6 in the one-and-a-half decades of fulfilling the Comprehensive Program, in many ways due to collaboration.

The long-term target programs for collaboration (DTsPS) in the five most important spheres of physical production became, as is known, the development and concrete definition of the Comprehensive Program. One of the basic directions for interaction, specified by the subprogram "Chemistry," is efficient division of labor in the production of energy-intensive and less energy-intensive chemical products. Energy- and material-intensive production facilities, according to the accepted concept, should be developed close to the sources of energy and raw materials, and the less energy- and material-intensive ones-- in the CEMA member countries which have at their disposal only limited raw material and energy resources. This principle was put into practice in the multilateral general agreements and bilateral governmental agreements, signed in 1979, on specialization and cooperation of energy-intensive and less energy-intensive chemical production. In addition, under the procedure for fulfilling DTsPS, a General Agreement was signed on setting up, through the combined efforts of the interested CEMA member-countries, a nutrient yeast plant in Mozyr (USSR).

To ensure supplies of energy-intensive products, additional capacities were put into operation in the USSR in 1981-1985 to produce methanol, ammonia, carbamide, low-pressure polyethylene and polyvinyl chloride, and the output of potassium fertilizers was expanded. In the countries participating in the agreement, new units were developed and existing ones were expanded for the production of chemical pesticides (Hungarian People's Republic), chemical additives (GDR and CSSR), etc. On the whole, in 1981-1985, in accordance with the agreements, the commodity turnover of chemical products rose almost four-fold and exceeded 850 million rubles.

Construction of the Mozyr plant for the production of 300,000 tons of nutrient yeast made from highly refined liquid petroleum paraffins began in 1979, with the active participation of the GDR, the Republic of Cuba, the CSSR and the Polish People's Republic. In 1983 the first underway complex was introduced, and in 1984 supplies of nutrient yeast in volumes coordinated under bilateral procedure had already begun to be delivered to the other countries participating in the agreement.

The Commission's activity with respect to solving the problems arising from DTsPS in the sphere of agriculture and the food industry was concentrated on providing agriculture and the food industry primarily with mineral fertilizers, chemical pesticides, products for the microbiological industry, packing materials, etc. Our Commission worked out measures for 12 collaboration projects.

The Comprehensive Program specified coordination of the efforts of the CEMA member countries for more complete satisfaction, for 1980-1985, of the needs

of the agro-industrial complex for mineral fertilizers, with respect to both the overall volume and to the assortment, primarily through their own production or through reciprocal supplies. At present, this goal has been achieved in providing for the demands for nitrogen and potassium fertilizers. As for fertilizers containing phosphorus, their output is limited by a shortage of the raw material resources--apatites and phosphorites. On the whole, the supplies of mineral fertilizers for agriculture in the CEMA member countries rose in 1985 by a factor of almost 6.8 as compared with 1960.

The supplies of chemical pesticides have considerably increased. In 1985 their production more than doubled as compared with 1970, but the assortment demands have not so far been satisfied.

The Commission has been engaged in solving ten problems of collaboration in the sphere of industrial consumer goods.

Since 1973 a multilateral agreement on the problem, "Developing New Chemical Consumer Goods, Improving Existing Industrial Processes and Developing New Ones," has been in effect. Its realization is contributing to the output of new products, the assortment of which is expanding from year to year. In the last five years alone, about 250 new commodities have been developed and introduced, including 114 detergents and 112 aerosol-packaged items.

Yearly exhibits within the framework of the international chemical trade fair of INKhEBA [not further identified] play an essential role in the development of the collaboration. Household chemical commodities, the quality of which is not inferior to the best world prototypes, are demonstrated there.

Scientific research work has been concentrated on improving the quality of chemical fibers and expanding the assortment and raising the quality of textile-accessory agents for the light and other sectors of industry.

In the course of time, the CEMA member countries have built up experience in collaboration. The Council's session at the 32d sitting approved the Basic Directions for Further Improvement in the Organization of Multilateral Collaboration of the CEMA member countries and the Activity of the Council, in accordance with which, at the 53d sitting of the Commission (1978), Specific Measures for Further Improvement of the Organization of Multilateral Economic and Scientific-Technical Collaboration of the CEMA Member Countries in the Chemical, Paper and Pulp and Microbiological Industry and a new organizational structure for the Commission were adopted.

From January 1979 to the present, multilateral collaboration in the Commission has been implemented in ten permanent working organs, including nine sectorial sections and the Scientific-Technical Council on Environmental Protection and Improvement. To work out problems that do not come within the competence of the sections and the Council, the Commission is organizing temporary working organs, such as a conference for the directors of planning administrations and science and technology administrations of the ministries (departments), as well as conferences of specialists from the countries on individual collaboration problems.



## The Development of International Specialization and Cooperation in Production (MSKP)

In the structure of reciprocal export of specialized and cooperative industrial output of the fraternal countries, chemical commodities occupy second place, yielding only to machine building items. In 1985, reciprocal export of the products of the chemical industry reached 8 billion rubles. In 1985 the volume of reciprocal export of specialized and cooperative chemical products was 2.3 billion rubles and increased by 14.4 percent as compared with 1984, and for 1981-1985--increased by a factor of over 2.2.

In 1981-1985, reciprocal supplies of specialized chemical products were implemented in accordance with 22 agreements/contracts. Ten new agreements/contracts on MSKP were prepared, and work is being done on signing the protocols on extensions and supplements, for 1986-1990, of the existing agreements/contracts on MSKP. On the basis of this, a considerable increase in volumes and expansion of the products list for reciprocal supplies is specified, including ammonia and methanol--almost double; cellulose, paper and cardboard--by a factor of over 10; chemical additives--a factor of 3.3; pharmaceuticals--from 82 to 185 items; chemical and biochemical additives--from 9 to 22 items.

Progress in developing MSKP and reciprocal supplies of chemical products is therefore considerable, but the possibilities of collaboration are far from exhausted. In this connection it is important to seek new paths to expanding the products list and the production volume of specialized goods and further development of reciprocal commodity exchange. It should be the basic source of providing the CEMA member countries with chemical commodities and reinforcing their technical and economic independence from capitalist countries.

### In the Service of Scientific-Technical Progress

Due to the development of MSKP, conditions have been created for a transition to higher forms of cooperation in the sphere of scientific-technical research, including that on a contractual basis.

As a result of their development in pilot and semi-industrial units, the newly created technological methods and processes have come into use on a major industrial scale. This pertains, for example, to the production of polypropylene fibers, fibers of acrylonitrile copolymers, heat-resistant polymers and copolymers, ethylene-propylene rubber, cellulose, combined potassium and calcium phosphate, concentrated mineral fertilizers based on nitric and phosphoric acids, etc.

The Commission's recommendations on automating the production processes to make ammonia, methanol, sulfuric acid, phthalic anhydride and chlorine were put into practice with good results. Presently, among the sector's most pressing scientific and technical problems are an increase in the production of new polymeric materials, particularly for microelectronics, and chemical additives; advanced pesticides; improving the quality and expanding the assortment of reciprocally supplied products; a set of measures for efficient use of material resources and the introduction of resource-saving technology.

The Commission is carrying out joint scientific-technical research in accordance with individual agreements outside the framework of its working bodies on a number of new problems, mainly pertaining to the introduction of computer equipment, automated control systems, model study and design.

In accordance with the resolutions of the CEMA Session (34th and 35th sittings) and the Executive Committee (110th sitting) within the framework of the Interkhim MEO, which was entrusted with overall coordination of work on the cycle science-technology-production, extensive work has been done on providing the radio engineering and electronics industry with the necessary materials, now and in the future. The basis of this work is a refined products list, import demands and technical requirements, approved by the CEMA Standing Commission on Collaboration in the Radio Engineering and Electronics Industry.

As a result of the scientific-technical relations of the Interkhim MEO member countries, in 1985, 16 industrial processes for obtaining particularly pure substances for microelectronics were put into production in the GDR, and the experimental production of 4 of them was begun in the USSR, and of 12—in the CSSR. Of the 44 products necessary for microelectronics, in accordance with the refined products list for 1986-1990, 37 products will be placed on a contractual basis. Supplies of 91 special materials will be ensured on the basis of multi- and bilateral agreements on specialization and cooperation for radio engineering and electronics.

Preparation of promising scientific-technical programs of long-term collaboration has been widely applied recently in the work of the Commission. These are primarily programs for economical and efficient use of fuel-energy and material resources, including secondary resources, in the chemical, paper and pulp and microbiological industries up to the year 2000, and in the use of robot-operators and microprocessing and computer equipment in these sectors up to 1990. Although these programs are promising, introduction of the developments that have already been completed is yielding a considerable economic effect today.

Economic and scientific-technical collaboration of the CEMA member countries with the Socialist Federated Republic of Yugoslavia has developed successfully within the framework of the Commission. Specialists of Yugoslavian enterprises and organizations are working actively in the sections for petrochemistry, plastics, varnishes and paints, tires and industrial rubber items, mineral fertilizers, paper and pulp and the microbiological and pharmaceutical industries. The Socialist Federated Republic of Yugoslavia is taking part in carrying out 12 agreements on multilateral economic collaboration and in a multilateral agreement on scientific-technical collaboration. Its participation in three other agreements on scientific-technical collaboration is specified.

On the whole, the growth in the volume of reciprocal supplies between the CEMA member countries and the Socialist Federated Republic of Yugoslavia with respect to products of the chemical, paper and pulp and microbiological industries was 27 percent in 1984, as compared with 1980.

The high-level Economic Conference held in 1984 occupies a special place in the development of economic relations, at a qualitatively new stage, in the CEMA

member-country collaboration. The results of the conference signify a new stage in relations between the fraternal parties and countries, and in conformity with them, of economic and scientific-technical policy. In regarding utmost acceleration of scientific-technical progress as particularly urgent, the Economic Conference emphasized that, for a joint solution to problems of historic significance and emergence to advanced frontiers of science and technology for the purpose of a further growth in the well-being of the peoples of the CEMA member countries in economic collaboration, a consistent unification of the efforts of the fraternal countries in the key directions of intensifying production and accelerating scientific-technical progress is becoming particularly important. With the adoption of the Comprehensive Program of Scientific-Technical Progress of the CEMA Member Countries up to the Year 2000 (KP NTP), the requirements of the scientific-technical revolution are increasingly reflected in the content of the collaboration within the framework of our Commission. Intensifying specialization and cooperation in the scientific-technical and production spheres is becoming the chief direction in the present strategy of socialist economic integration in the chemical industry as well.

To improve the production structures, work out mutually coordinated paths of development for the economic systems of the countries and achieve greater interchangeability in the national economic complexes, the CEMA member countries arranged to carry out efficient coordination of capital investments in spheres of mutual interest. For example, within the framework of the Commission, the Interkhim MEO and the Interkhimvolokno MKhO are coordinating capital investments to set up new production capacities through the joint efforts of the interested countries up to 1990 and for a longer period. The Commission examined the technical and economic considerations and the plan for general agreement on setting up, through the joint efforts of the CEMA member-countries, catalyst production facilities on the territory of the USSR. Plans for general agreements on the development and production of commodities containing phosphorus in the region of Lake Hubsugul (Mongolian People's Republic) and in the Socialist Republic of Vietnam are being worked out. Coordination of capital investments within the framework of the Interkhim MEO is directed toward developing new, small-tonnage chemical products and toward more complete satisfaction of the needs of radioelectronics, light industry and other sectors of the national economy.

Conformity of the economic policy of the countries of the socialist commonwealth is a voluntary coordination of the interests, aims and actions of sovereign states with equal rights. Our Commission concentrates its work on strategical, priority problems that are of general interest for the fraternal countries. This is being furthered by the Commission's approval, in October 1985, of the Long-Range Program for the Development of MSKP on a Selected Products List in the Corresponding Sectors of the Commission's Sphere of Activity up to the Year 2000, coordinated with KP NTP. The Long-Range Program contains the top-priority problems of MSKP in the chemical, paper and pulp and microbiological industries and ensures stable, long-term relations among the fraternal states. All the CEMA member countries and the Socialist Federated Republic of Yugoslavia, and the Interkhim MEO and Interkhimvolokno MKhO are taking part in putting it into effect.



The selected products list included in the Long-Range Program is of strategic importance for the development of the corresponding sectors of the national economy and is aimed at the intensive production and scientific-technical cooperation of the CEMA member countries, more efficient use of their economic potential and reinforcement of their technical and economic independence.

The CEMA Session (39th sitting) adopted a resolution "On Further Improvement in the Organization of Multilateral Collaboration Within the CEMA Framework." The goal set was to improve the contractual system of collaboration for comprehensive development and implementation of scientific-technical and production tasks, consolidate the agreements and mutual obligations and intensify the responsibility of the countries for their fulfillment. In connection with this, the Commission reviewed the existing practice of preparing agreements/contracts on economic and scientific-technical collaboration. A list was drawn up of the most pressing problems in coordinating with KP NTP, the realization of which was specified on a contractual basis.

#### Participation in Carrying Out KP NTP

In January 1986 the Commission approved specific measures to realize the priority directions of KP NTP relating to the sphere of activity of our Commission. This is one problem of the first priority direction, "Electronization of the National Economy"; two--of fourth priority--"New Materials and the Technology to Produce and Process Them"; and six--of fifth priority--"Accelerated Development of Biotechnology." Along with this, the Commission is participating in working out six more problems of the fifth priority direction and individual problems of the second--"Complete Automation." Detailed programs of collaboration for the fourth and fifth priority directions of KP NTP have been approved by the Commission and two interdepartmental agreements in the sphere of synthesizing and processing polymers and one in the sphere of industrial biotechnology have been signed. The programs on collaboration for the fourth priority direction specify implementation of 12 independent assignments, each of which is a system of scientific research and planning-design work for the entire cycle, science-technology-production.

From the USSR alone, 11 leading organizations--coordinators for the problem--are taking part in the agreement on industrial biology. The programs for collaboration contain about 200 independent assignments, subjects and stages. On the whole, the problems of the fourth and fifth priority directions of KP NTP relating to the Commission's activity are being worked out by about 100 coordinating organizations. The scientific organizations of the CEMA member countries must carry out 41 collaboration programs. A number of research projects are also being carried out for the first and second priority directions within the framework of the chemical industry.

Here, the most important task of the Commission is to organize collaboration directed toward further realization of KP NTP, to prepare and sign agreements and contracts, as well as protocols on extending or refining existing agreements/contracts and to coordinate work on using in production the most recent scientific-technical results obtained in fulfilling agreements concluded earlier on collaboration and serving as the subject of KP NTP and measures for the

accelerated use of these research results, including those based on production specialization and cooperation; to organize broad reciprocal exchange of information among the countries on the results of scientific research work and on existing technology for the purpose of their most rapid introduction into all the interested CEMA member countries.

The Commission's activity is also directed toward reinforcing the technical and economic independence of the CEMA member countries and reducing the importation of chemical products from capitalist countries, toward fulfilling a set of measures for economical and efficient use of fuel-energy and material resources, including secondary raw material, introducing resource- and energy-saving industrial processes in production, toward developing and intensifying multilateral specialization and cooperation in the production of chemical goods and widescale use of cooperation in scientific-technical collaboration and toward using new forms of it, including direct relations between the economic organizations of the countries.

In accordance with the Long-Range Program for the Development of International Production Specialization and Cooperation in the Chemical, Paper and Pulp and Microbiological Industries up to the Year 2000 in Coordination With KP NTP, an important place in the Commission's work will be occupied by specialization and cooperation in new spheres of chemical production, including the output of catalysts, advanced and structural plastics, chemical reagents, particularly pure substances, and new household chemistry products, and also by intensifying and expanding collaboration within the framework of the General Agreement on Energy-Intensive and Less Energy-Intensive Chemical Products and preparation to extend its effective period past 1995.

The Commission, the Interkhim MEO and the Interkhimvolokno MKhO are continuing accelerated development of proposals on satisfying the demands of the countries for preservatives for fodder grain, for raw material and semi-finished products for the pharmaceutical industry and for the materials necessary to the radio engineering and electronics industry, and on increasing the production of highly concentrated and combined mineral fertilizers, including those with trace elements, as well as on setting up production capacities for the output of chemical fibers.

In the near future the Commission will direct its efforts toward coordinating production capacities in individual countries, in order to eliminate unwarranted parallelism in the output of chemical products.

The high-level Economic Conference of CEMA Member Countries placed on the agenda a transition to qualitatively new frontiers of economic integration, not only through expanding collaboration, but also, primarily, on the basis of increasing its efficiency. This, just as carrying out the resolutions of the 27th CPSU Congress and the congresses of the other fraternal communist and workers' parties, is the main purpose of the Commission's activity in the interests of all the countries of the socialist commonwealth.

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## CRYOGENICS: USSR ACCOMPLISHMENTS AND PROSPECTS

Moscow SOVIET EXPORT in English No 6, Dec 86 pp 11-14

[Article by Source correspondent based on interview with Corresponding Member of the USSR Academy of Sciences V.P. Belyakov, General Director of Kriogenmash Research and Production Association]

[Text] The USSR produces over 30 percent of the world's oxygen and nitrogen. The country is also in the lead in the manufacture of air-separation plants, the traditional and most important type of cryogenic technology.

The industrial use of cryogenic equipment began in the USSR back in the 30s and relied on extensive fundamental research in the field of low-temperature physics, research initiated and directed by the world-renowned physicist Academician Piotr Kapitsa, E. Rutherford's close associate and a Nobel Prize winner. Turboexpanders developed by P. Kapitsa made it possible to carry out on an industrial scale the processes of air liquefaction and separation into nitrogen and oxygen. At present all of the air separation plants throughout the world have Kapitsa turboexpanders.

Today, cryogenic engineering is regarded in the Soviet Union as a key industry that most actively affects the process of accelerating scientific and technological progress. In accordance with the Guidelines for the Economic and Social Development of the USSR, the output of cryogenic equipment embodying novel technological processes will within the next few years increase substantially.

The volume and geography of Soviet exports of cryogenic equipment is constantly expanding: today it is being bought by firms and organizations of 50 countries. Foreign trade organizations of the CMEA countries, viz., Polimex-Cekop and Centrozap (Poland), Industrialexportimport (Romania), and Chemokomplex (Hungary) are among the major purchasers, for instance, of Soviet-made air separation equipment. Air separation plants made in the USSR are also functioning in Britain, Finland, India, Italy, Lebanon, Singapore, Yugoslavia and other countries.

## Cooling and Subsequent Separation

The most important traditional type of cryogenic equipment is an air separation plant. The large-tonnage plants now in quantity production in the USSR turn out gaseous and liquid oxygen, nitrogen, argon, a neon-helium mixture, and a high-purity krypton-xenon concentrate. Significantly, the Soviet-made plants require no special alteration when used in conjunction with ancillary equipment intended for crude argon purification from oxygen, the preparation of pure krypton and xenon, and for the storage, gasification and delivery of the requisite amounts of cryogenic products to consumers.

In full-scale production in the USSR are 10 types of large-tonnage plants having an hourly capacity of 5,000 to 70,000 cu.m of oxygen and over 15 types of plants with a capacity of 20 to 1,600 cu.m. So great a variety of available plants enables the customers to select the equipment that meets all specific requirements involved in anticipated applications.

In the course of designing new air separation plants, a method was elaborated whereby the process of rectification could be markedly intensified, and a new and more effective type of basic contact elements for columns was developed, viz., sieve plates with a radial liquid flow. Accordingly, the vapor and liquid loads experienced an approximately twofold increase, while ensuring a high degree of hydrodynamic uniformity of the contacting phases. Owing to the novel design of contact elements, the cross-sectional area of rectifying columns was halved or, alternatively, the column height could be reduced by 25 percent. The assembled relatively compact columns are, therefore, adapted for transportation by rail or motor vehicles and upon arrival are ready for immediate mounting.

All Soviet-made air separation plants processing over 8,000 cu.m of air per hour are equipped with rectifying columns of the new type. The high- and medium-pressure air separation plants processing up to 3,000 cu.m of air per hour incorporate rectifying columns with interplate phase separation, the plate spacing in such columns being not greater than 40 mm as compared to 60 mm in the columns used abroad. As a result, the height of a rectifier assembly is reduced and equals 1.5-2 m.

The Soviet air separation plants are absolutely explosion-proof. Provision is made in the plants for systems intended for the removal of hazardous impurities dissolved in liquid oxygen, and particular care is exercised in preventing the deposition of explosive impurities onto the surface of evaporative condensers in the course of oxygen boiling. A three-stage system of deposition prevention guarantees complete safety and reliability of plant operation. In the between-defrosting period (continuous operation duration), the deposited hydrocarbon layer would by no means reach the critical thickness.

In the past few years the Kriogenmash Association has brought to commercial status a process of manufacturing highly efficient heat-exchange elements to be used in the apparatus where cryogenic liquids boil on tubes having an external

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Photo, not shown of big helium works in Orenburg, equipped with high-capacity Soviet-made equipment: air separation plants, efficient in helium liquefiers and a cryogenic product storage system.



coating with capillary porosity. In contrast to the production processes employed by leading foreign firms, this method ensures a greater uniformity of the coating applied onto the heat exchanger surface, the heat transfer intensity in an apparatus furnished with these tubes is increased by a factor of 2 to 2.5, and such tubes find application in all Soviet medium-pressure air separation plants.

#### Evaporation Losses--A Fraction of a Percent

The increased output and consumption of cryogenic products necessitated the development of systems for the storage and transportation of liquefied gases.

Particularly high requirements are to be met by the insulation of liquid hydrogen and helium storage vessels. Our experts have developed an evacuated multilayer insulation that complies with these requirements and consists of layers of a polyester film aluminized on both sides and a glass-fiber material spacer between these layers. The thermal conductivity coefficient of the evacuated multilayer insulation equals from one-third to one-fifth that of an evacuated powder insulation.

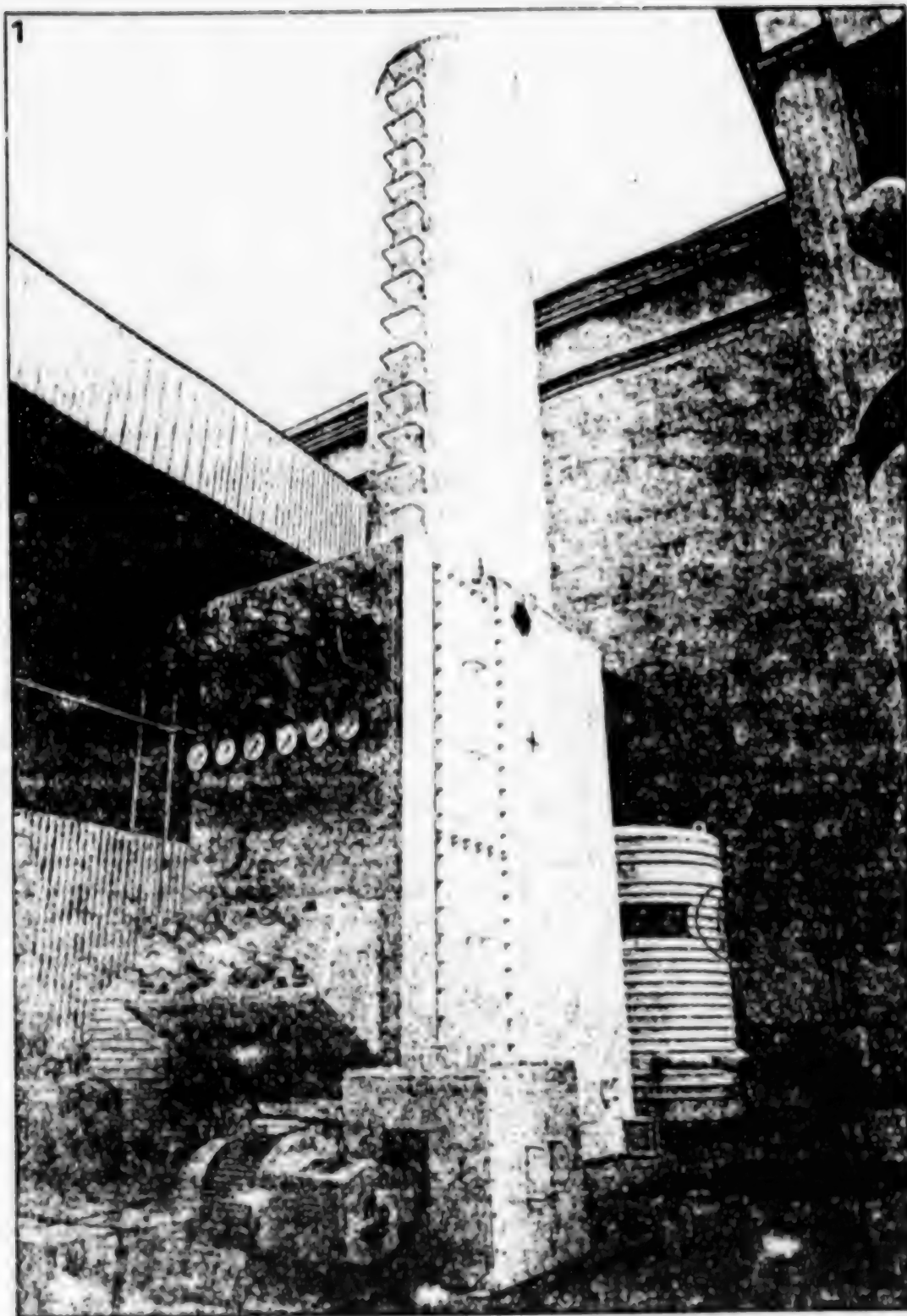
Various vessels, reservoirs, tanks etc., having a capacity of 5l to 1,400 cu.m and intended for the storage and transportation of cryogenic liquids are being produced in quantity in the USSR. The vessels, reservoirs etc., are double-walled apparatus of the vessel-in-vessel type, wherein the interwall space is evacuated, and the desired vacuum is maintained during a period of three to five years by cryosorption vacuum pumps.

Cryogenic tubing is likewise in full-scale production in the USSR. Separate sections up to 12 m long are available and assembled at the construction site. Pipelines of any configuration are assembled from unified sections, such as straight sections, elbows, tees, adsorption sections, external supports and couplings.

The employment of the novel evacuated multilayer insulation in cryogenic tubing has made it possible to greatly minimize heat influx to cryogenic products, which does not exceed 2 or 3 W in the case of liquid helium flow through a pipeline 50 mm in diameter.

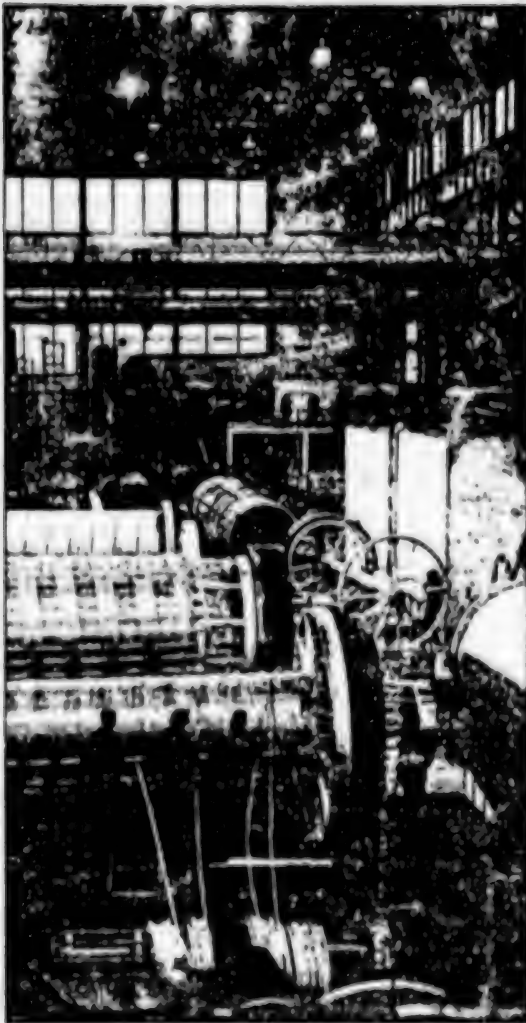
The employment of superconductivity provides a key to the solution of diverse problems in power and electrical engineering and high-energy physics, while the operation of superconducting systems calls for a large-scale application of cold at superlow temperatures (3 to 10 K). Effective cryogenic support equipment developed and currently produced on a large scale in the USSR has demonstrated its usefulness in many industrial and research fields, as can be seen from the following examples of employment.

The Soviet Union pioneered in the development of a thermonuclear installation known as Tokamak-7, in which use is made of a superconducting magnetic system. In the system of cryogenic support the principal component is the ORG-100 250/4.5 liquefier-refrigerator with a liquid helium output of 100 l/h. The liquefier is adapted for a quick change-over, from one duty to another, depending on the purposes of the experiments carried out on the thermonuclear installation.

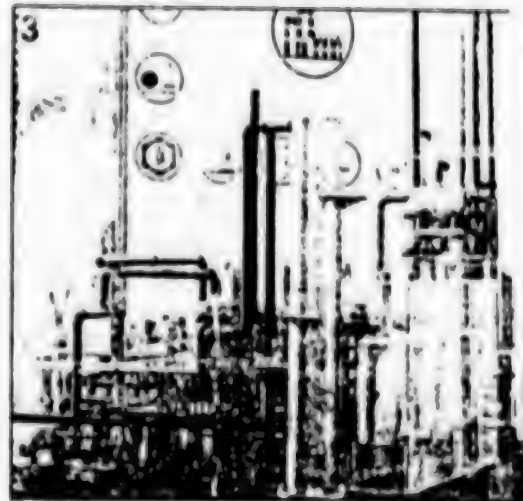


The K-0.15 air separation plant produces oxygen up to 99.9 percent pure. Energy expenditures on the starting and thawing this plant have been minimized: these operations are performed only twice a year.





The Kriogenmash Research and Production Association quantity-produces heavy-duty air separation plants.



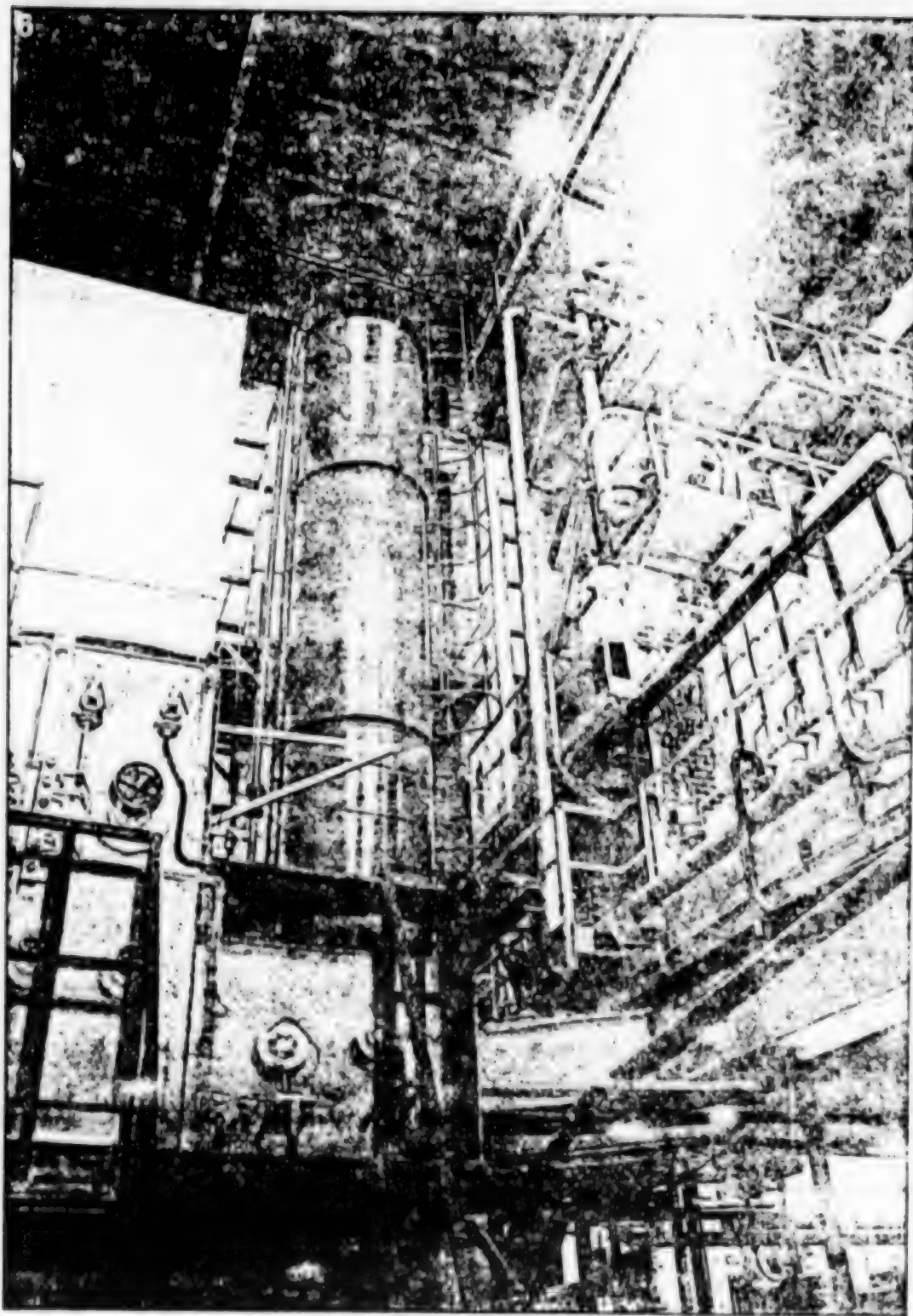
The AK-15P plant widely used at nitrogen- and oxygen-consuming enterprises produces 15,000 m<sup>3</sup> of highly-pure nitrogen and 5,800 m<sup>3</sup> of technical oxygen per hour.



The sieve plates of new design ensure good phase-contact conditions and intensify the rectification process.



A turbo-expander is the heart of an air separation machine.



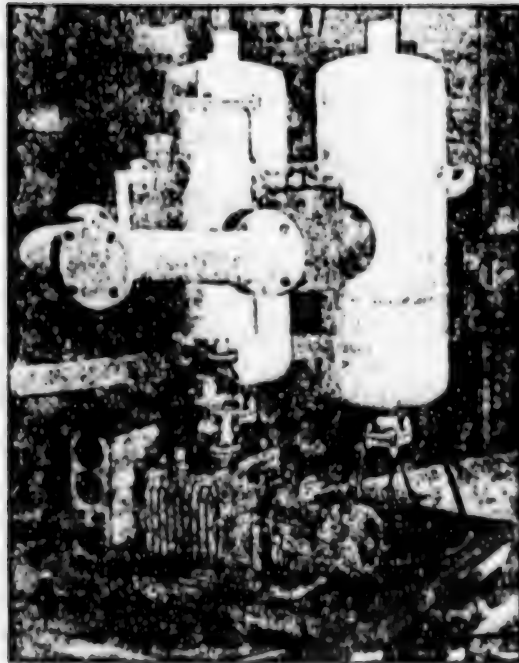
The Kriogenmash Research and Production Association's large test-beds make possible full-scale trials of new air separation plants.

# HIGH-CAPACITY LOW-PRESSURE AIR SEPARATION PLANTS

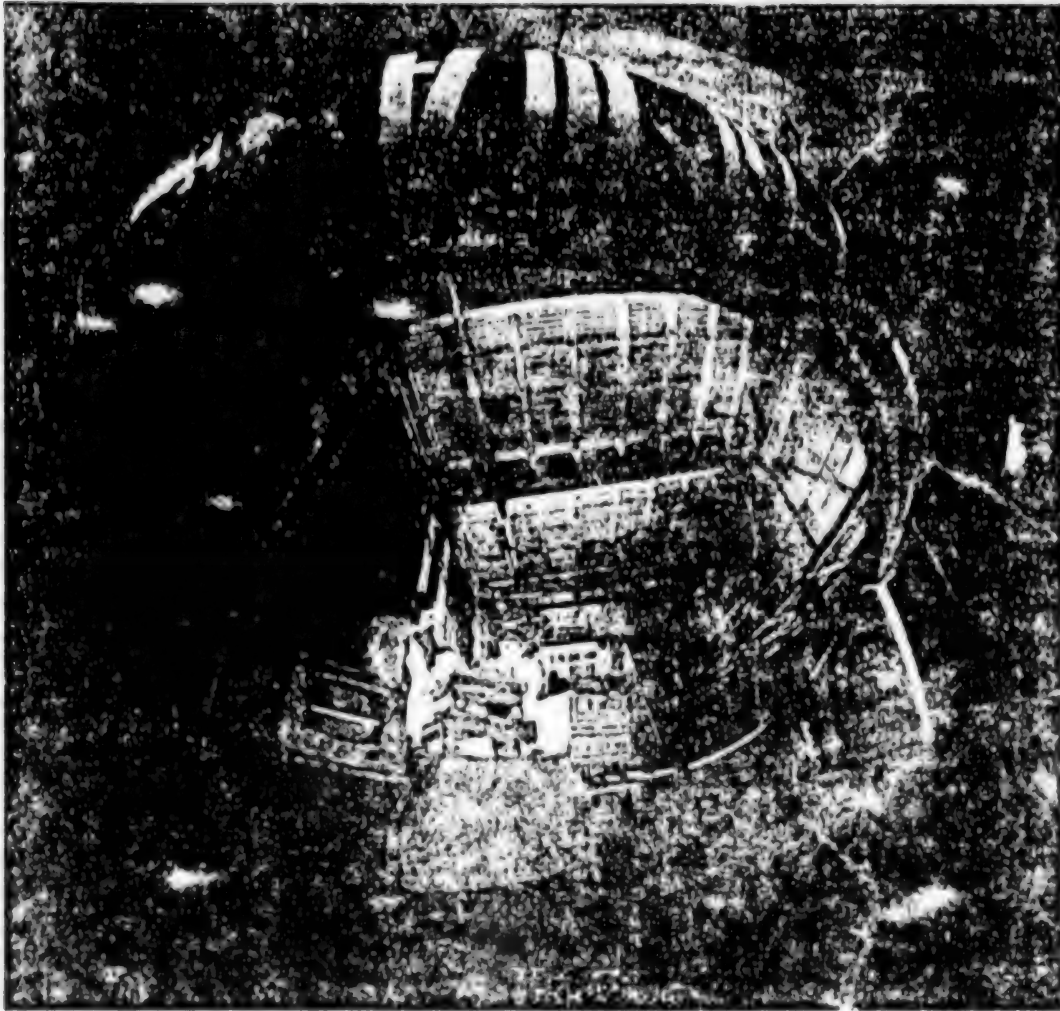
	KI-70	KIA-35	KA-32	AKI-30	KA-15	KAAP-15
Inlet air volume, cu.m/h	350,000	180,000	180,000	85,000	85,000	85,000
Inlet air pressure, MPa	0.525	0.52	0.56	0.5	0.53	0.54
Plant capacity:						
Gaseous products, cu.m/h						
nitrogen (99.9% N <sub>2</sub> )	30,000	22,000	25,000	30,000	16,000	16,000
process oxygen (95% O <sub>2</sub> )	66,000	34,500	—	17,500	—	—
industrial oxygen (99.5% O <sub>2</sub> )	—	—	30,000	—	15,500	15,500
Liquid products, kg/h						
nitrogen	5,050	1,500	1,200	—	—	130
industrial oxygen	5,050	1,900	1,600	—	—	—
argon (99.9% Ar)	—	—	—	—	—	300

# MEDIUM-CAPACITY MEDIUM-PRESSURE AIR SEPARATION PLANTS

	AK-1.5	K-0.4	AK-0.6	A-0.6	K-0.15
Inlet air volume, cu.m/h	2,600	2,600	960	900	960
Inlet air pressure, MPa	4—5	5	4—5	4.5—5	5
Plant capacity, cu.m/h:					
gaseous nitrogen (99.9% N <sub>2</sub> )	1,625	—	605	550	—
gaseous oxygen (99.7% O <sub>2</sub> )	230	450	87	—	168



The AKS-200 cryosorption unit is used for obtaining high vacuum in chambers when testing biological objects.



The GSPK-50 superconducting flexible cable. Its cryogenic supply system's refrigerating capacity amounts to about 400 W at the 4.5 K level.



A versatile helium cryostat with a 92 cu.m refrigerant cavity has been developed specifically for use in a more powerful experimental thermonuclear installation, the Tokamak-15. The cooling and cryostatting of the magnet sections being tested is effected by the ORG-250 1,200/4.5 automated cryogenic helium unit capable of functioning under various operating conditions, producing 250 l/h of liquid helium and with a cooling power of 1,200 W at 4.5 K.

Cryostatting the magnets under operating conditions that involve enhanced heat evolution necessitates the employment of an additional helium liquefier, the OG-200 with a capacity of 200 l/h, and a 40 cu.m liquefier receiver.

That same complicated problem of creating superconductive magnetic systems is faced by development engineers engaged in designing magnetohydrodynamic generators. In power plants based on MHD generators, use is made of immersible superconducting magnetic systems, wherein the magnets are cryostatting by immersion in boiling liquid helium.

Thus, in the case of a 100 MW MHD generator, immersible magnet cooling and cryostatting is provided by the OG-300 helium liquefier with an output of 300 l/h. In this generator, the cryogenic support system makes it possible to cool the cryostat and magnet structure weighing 265 t from 300 down to 4.5 K at a minimal temperature stratification.

Cryogenic technology is indispensable in the development of cryothermovacuum chambers and outer space simulators. Insofar as any experiment in outer space is very expensive, it is essential to employ various simulators designed for testing different structures and production processes under the conditions similar to those of outer space. Soviet outer space simulators having a volume of tens of thousand cu.m are furnished with high-capacity cryogenic systems thanks to which it is possible to test real objects under conditions most closely resembling those prevalent in outer space.

A traditional field for the commercial application of superconductivity is power transmission lines. Projects undertaken in the Soviet Union have culminated in the development of two superconducting cables, viz., a flexible and a rigid one; the cooling power of the KGU 150/4.5 cryogenic helium unit amounted to 400 W at a temperature of 4.5 K. Current and high-voltage tests of the cables confirmed the serviceability of prototype specimens which were capable of transmitting in the superconducting state 9 kA direct and 1.8 kA alternating current.

Work is also now under way in the USSR to develop cryogenic superconducting electric motors and generators. The Electrosila Association constructed a 300 MW generator of this type. In principle such machines make it practicable to exceed by a factor of 3 to 5 the maximum power ratings obtained at present in a single generator (motor) with conventional windings.

/9835

CSO: 1841/392-E

## MEMBRANE TECHNOLOGY: SEPARATION WITHOUT RECTIFICATION

Moscow SOVIET EXPORT in English No 6, Dec 86 p 15

[Article by STEM V/O Techmasheexport, Moscow]

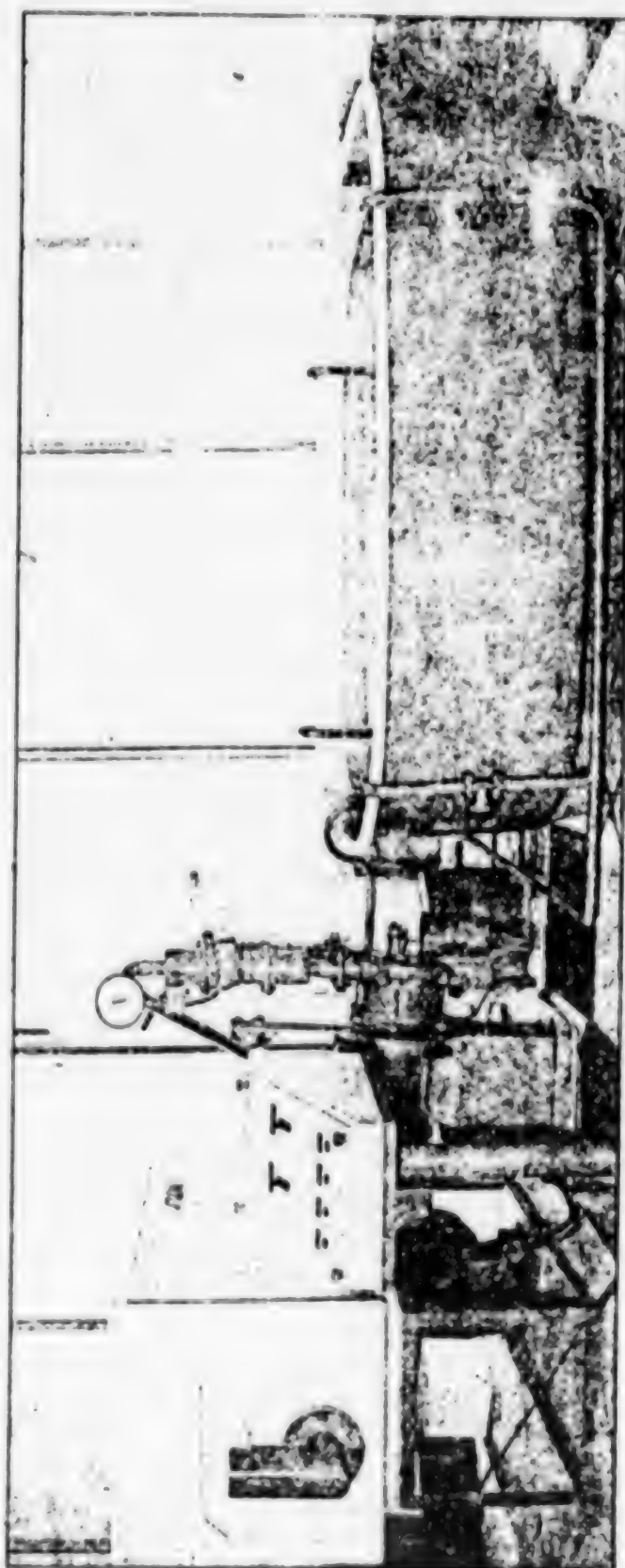
[Text] The technology and installations based on the principle of selective permeability and intended for the separation of gaseous mixtures are the result of efforts of Soviet scientists and engineers. Maintenance simplicity and inertialess operation are the distinctive features of these installations which require a maximum 2 or 3 minutes for operation starting or termination.

The membrane installations are adapted for air enrichment with oxygen (up to 40 percent) or nitrogen (up to 95 percent), the purification of gases from sulphur-containing compounds, hydrogen extraction from off-gases of ammonia production facilities, helium purification from oxygen, nitrogen and carbon dioxide admixtures, and for the preparation of special-purpose gaseous mixtures to be used as highly efficient media for the storage of explosives and food products.

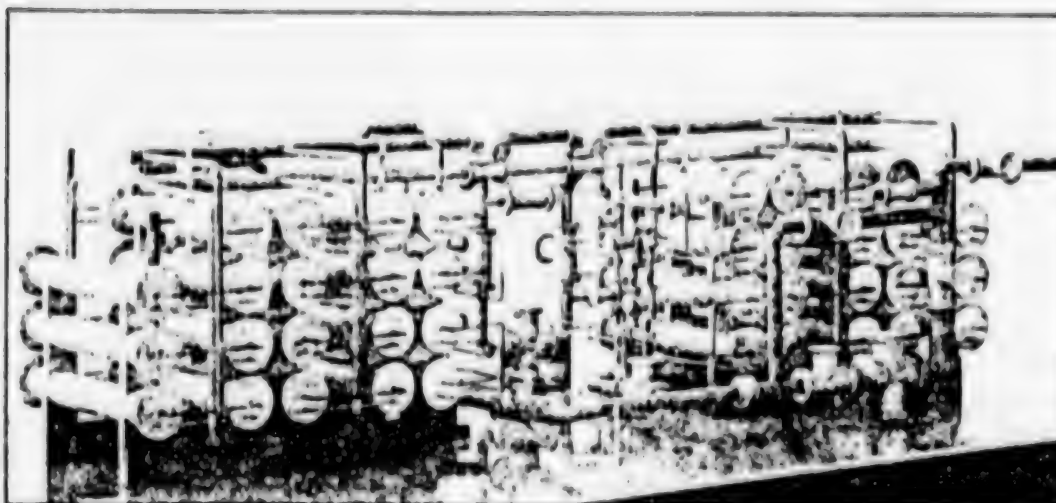
The layout of membrane installation components ensures gas separation uniformity, and the installations display a high specific output due to the high permeability and close packing of the membranes used. For example, an apparatus measuring 600 x 700 x 1,000 mm overall and operating at atmospheric pressure is capable of producing 15 cu.m per hour of air enriched with oxygen up to 40 percent. Owing to their modular design, the performance efficiency of membrane installations can be varied within a broad range. Moreover, the process parameters of an installation lend themselves to adjustment in the course of operation by varying the working surface area of membranes.

The membrane apparatus in question finds application in fields where the employment of cryogenic air separation plants either involves difficulties or is unprofitable.

The use of membrane installations is particularly effective in medicine. For instance, membrane installations disposed outside a medical establishment ensure the supply of oxygen-enriched air to clinics or preventoria. Inotek-type compact medical-purpose air enrichment units have been developed for use in any clinic or even at home at a sickbed.



Introduction of membrane units for enriching air with oxygen increases fisheries' productivity 2 times.



The MV-9.0 membrane gas separation unit without low-temperature rectification enriches various gas mixtures with the necessary component.

The employment of membrane installations in incubation departments of fish-farming enterprises has doubled their productivity.

The membrane technology, an unsophisticated method of air enrichment with oxygen, offers much promise as a means of sewage aeration at waste disposal plants. The membrane installations intended for obtaining concentrated nitrogen are a useful source or protective media to be employed for the transportation of explosives and inflammable materials, e.g. in tankers.

The membrane technology has been used to develop gas medium automatic control blocks. Known as BARS, these are capable of generating gaseous media and maintaining therein the optimum composition in terms of nitrogen, carbon dioxide and oxygen concentrations. The employment of such units for the storage of perishable agricultural produce, e.g. fruits, vegetables, berries or seeds, reduces losses fivefold.

/9835

CSO: 1841/392-E

TASKS OF CHEMICAL INDUSTRY LABOR UNION AND ITS CONTRIBUTION TO ACCELERATION  
OF SOCIAL-ECONOMIC DEVELOPMENT OF THE INDUSTRY

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 4, Apr 87, pp 195-201

[Article by V.K. Borodin, Central Committee Chairman, Chemical and Petro-  
chemical Industry Labor Union]

[Abstract] The Central Committee of the Chemical Worker's Union directed its efforts in 1986 toward development of the labor and creative initiative of the workers and scientists of the industry. It is the union's task to protect successes achieved and to create a tense atmosphere of struggle in each working team, seeking means to meet the plan for the second year of the 12th Five-Year Plan, transforming 1987 into a year of shock labor. Several examples are given of chemical industry enterprises where the need to re-think and redesign the organization of the labor process has been met with formalized, unthinking analysis and poor results. Examples of ineffective approaches to worker safety and the provision of benefits to the workers are also noted. The significance of labor unions in the general restructuring of the economy must be carefully analyzed. Unions must concentrate their efforts on teams of workers, the basic element of restructuring, and the place where the fate of restructuring will be decided. Labor unions have the honorable duty of assuring that the economic and social programs set forth by the Party are implemented. Unions must serve as a counter-balance to technocratic attitudes, guaranteeing the success of restructuring. Unions will be important in the expansion of democracy, awakening the labor activity of the masses, and directing their energy toward the battle against inertia and resistance.

6508/9835  
CSO: 1841/380



## RESERVES OF COMBINED UTILIZATION OF MULTICOMPONENT RAW MATERIALS AT CHEMICAL ENTERPRISES

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 4, Apr 87 pp 240-244

[Article by A.D. Trusov and M.F. Krylov]

[Abstract] Combined utilization of multicomponent raw materials can greatly increase the efficiency and output of industry. For example, the apatite-nepheline ores of the Khibinsk deposit are not over 60-65% utilized. This same deposit could yield additional alumina, soda products and cement worth 14-15 million rubles. The major factor in combined utilization of raw materials is maximum possible extraction of all useful components for the benefit of the economy, requiring the development of new technological processes, including biological processes, to replace traditional ones. Many products currently considered wastes could actually be valuable raw materials for the production of other products. Unfortunately, no national list of underutilized and unutilized products and production wastes has yet been published. Renewed efforts must be expended in development of waste-free technology, complete utilization of multicomponent raw materials, and the development and publication of a national list of available wastes and underutilized raw material.

6508/9835

CSO: 1841/380

## DEVELOPMENT AND PRODUCTION OF STANDARD METHOD OF COST ACCOUNTING AT DOMESTIC CHEMISTRY ENTERPRISES

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 4, Apr 87 pp 245

[Article by A.A. Garifullina and I.N. Ignatyeva]

[Abstract] Kazanbytkhim, one of the largest household chemical enterprises, specializing in the production of synthetic detergents and aerosol packaged products, has developed and introduced a standard method of cost accounting. The basis of this method is development of a system of standards and norms which determine the qualitative and quantitative proportions of funds consumed in the process of production. This set of standards serves as the basis for development of scientifically-justified indicators for 5-year and technical-industrial financial plans. The introduction of self-supporting operation and organization of socialist competition are quite difficult without organization of applicable standards. The system of norms and standards is used to develop standards cards and standards calculations, giving particular attention to material resources. The cards reflect the consumption



of materials and power at standard cost. Special reports are produced listing deviations from standards. This system of cost accounting and computational cost of products has been tested at 3 production facilities in Kazan, producing aerosol products, synthetic detergents and paints and varnishes. The economic effect of the use of the new cost accounting method has been 186,000 rubles.

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CSO: 1841/380

UDC 543.42.062:547.26

#### COMPETITION AND RESTRUCTURING OF ECONOMY

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 4, Apr 87 pp 252-255

[Article by A.A. Zhdanovich, L.I. Goldin, G.I. Komov and L.I. Leonido]

[Abstract] Socialist competition is presently being structured in accordance with the new economic conditions. This article reports on groups receiving awards in the All-Union Socialist Competition for 1986, including: the Slavgorod "Altaykhimprom" Production Association imeni G.S. Vereshchagin, where an automated production management system has been introduced; the Dnepropetrovsk Paint and Varnish Plant, where the systems approach to organizational, technical, economic and social problems has improved the quality of production, increased competitiveness and the productivity of labor while decreasing personnel requirements; the Volga "Orgsintez" Production Association, where output increased by 4.4% in 1986, including 9.3% in the production of consumer goods; the Cherkassk Chemical Reagents Plant, which has successfully filled its socialist obligation for the first year of the 12th Five-Year Plan; "Lentekhgaz" Production Association, a leading enterprise in the production of air separation products, presently working three shifts and operating at 99.2% of capacity; "Armbytkhim" Production Association, 15 times winner of All-Union Socialist competitions during the 11th Five-Year Plan; "Donkhimremont" Trust, supporting stable operation of 27 chemical industry enterprises in the Donets-Dnepr economic region, which completed the plan for the year on 25 Dec 1986; and the State Institute for Planning of Enterprises for production of plastic and chemical container products, which developed documentation for the construction during the 11th Five-Year Plan of 87 projects at 37 chemical plants. Socialist competition is among the most important forms of the development of democracy and encouraging the participation of workers in management, giving it an important role in the structuring of Soviet life. Winners of the All-Union Socialist Competition for 1986 in the Mineral Fertilizer Production Ministry include: Voskresenskiy "Minudobreniya" Production Association, which completed the annual plan on 26 December 1986; Ionavskiy "Azot" Production Association, which achieved a 13.2% increase in production over 1985; "Tekhenergokhimprom" Scientific-Production Association, which fulfilled the thematic plan and socialist

obligations for 1986, which achieved additional output and saved 18 million rubles; "Ukrkhimremnerdo" Production Association, which fulfilled the plan by 102%; Sumy "Khimprom" Production Association, which completed the plan on 18 December 1986; "Phosphaty" Production Association near Moscow, which fulfilled the plan 101.5%, increased productivity of labor by 4% over plan; and the Urals Scientific Research Chemical Institute and Experimental Plant, which fulfilled the plan for 1986 by 21 December 1986.

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CSO: 1841/380

#### NINTH ALL-UNION CONFERENCE ON CHEMICAL REACTOR 'KHIMREKTOR-9'

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 4, Apr 87 pp 255-256

[Article by A.V. Besspalov, V.V. Plamonov and I.A. Yursha]

[Abstract] The conference mentioned in the title was held 16-18 September 1986 at Grodno, involving 200 specialists from 60 organizations. Subjects covered included: current problems in mathematical modeling of chemical processes and reactors; methods of pneumometric measurement of flow speeds in a granular bed; use of thermodynamic analysis of chemical reactors to save energy; solution of nonlinear problems and problems of self organization, discussing the class of self-organization phenomena in which disruption of a homogeneous status is accompanied by development of unsteady dissipative structures when very fast processes develop in a medium. Very interesting properties appear in such cases, including paradoxical localization of heat during combustion, in which heat and combustion do not propagate into a cold medium. Mathematical development of self organization is frequently related to loss of stability of a homogeneous solution or appearance of periodic wave solutions or macrostochastic modes; kinetic models of reactions of industrial catalysts; intensification of processes of heat exchange in ammonia synthesis installations; and modeling of processes of radical polymerization. A resolution of the conference noted that the most important tasks of scientific research include organization of fundamental and applied studies of commercially important processes to increase the effectiveness of chemical technology processes.

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CSO: 1841/380

## AUTOMATIC CONTROL OF AMMONIA SYNTHESIS INSTALLATIONS

Moscow KOKS I KHIMIYA in Russian No 3, Mar 87 pp 43-45

[Article by G.A. Statyukh, doctor of technical sciences, and A.V. Fedorov, candidate of technical sciences, Kiev Polytechnic Institute, and V.F. Kopytov, NLMK [expansion unknown]]

[Abstract] Qualitative description is provided for the use of the computerized SM-2 system for exercising automatic control of ammonia synthesis installations, relying on coke-gas conversion. An outline is provided of the general algorithm, relying on programs analyzing and correcting various control parameters and providing operators with visual inflow of information on the state of the system. The system has now been in use for over two years, with current studies directed at expansion of the system to provide highly purified hydrogen. References 5 (Russian).

12172/9835  
CSO: 1841/326

UDC 613.6:66.013

## HYGIENIC PROBLEMS IN RECONSTRUCTION OF CHEMICAL PLANTS

Moscow GIGIYENA TRUDA I PROFESSIONALNYE ZABOLEVANIYA in Russian No 12, Dec 86 (manuscript received 20 Mar 86) pp 1-4

[Article by A.P. Mikhayluts, V.A. Zenkov, N.N. Davydova, Ye.G. Anastasova, L.M. Kuzminskaya, O.M. Drozdova, A.S. Krasnov and A.S. Urbanskiy, Medical Institute; Oblast Sanitary Epidemiologic Station, Kemerovo]

[Abstract] Examination was conducted on six reconstructed chemical plants from the viewpoint of industrial hygiene, in order to assess the causes of occupational health problems. The general conclusion was that in too many cases the needs of automation and industrial efficiency were regarded strictly from the technological side, with ergonomics and other hygienic parameters neglected. In addition to exposure to noxious chemicals, the problems were further compounded by inappropriate or inadequate illumination, poor ventilation, noise and vibrations at excessive levels and so forth. The net result of the combination of factors was that the workers suffered from fatigue, CNS disorders, respiratory difficulties, and changes in immunological reactivity and dermatologic conditions. These findings point to the need for the involvement of industrial hygienists in the early stages of planned reconstruction of chemical plants. References 1 (Russian).

12172/9835  
CSO: 1841/322

METHOD OF COMPUTING PROCESSES AND EQUIPMENT FOR  
SPRAYED STRIPS

OF TIRE TREAD USING WIDE

Moscow KAUCHUK I REZINA in Russian No 4, Apr 87 pp 16-21

[Article by M.I. Kalinin, N.G. Bekin and M.V. Ushenin]

[Abstract] In connection with the trend toward the use of robot systems for the manufacture of tires, it is particularly important to select equipment and technologies to automate manufacturing processes and quality control processes. The most effective method of manufacturing treads is by winding. The best tread quality is achieved by waste-free molding of the road-contact portion by drawing a broad strip of extrudate from turn to turn. The problem of parametric optimization of the process was solved considering the quality characteristics of the tread base using a mathematical model of the process and the method of calculating static-wound tread imbalance. The algorithm used is presented in the form of a flow chart. The theoretical and experimental studies performed were used as the basis for development of a computation method used by the Scientific Research Institute of Tire Manufacturing Machinery, in Yaroslavl to plan a tread-winding module to be used as a part of an automated system for manufacture of radial automobile tires prepared in 1986 for "Bobruyskshina" Production Association. Figures 3; references 10 (Russian).

6508/9835

CSO: 1841/391

UDC 541.124

QUANTITATIVE STUDY OF MECHANISMS OF PROMOTED HIGH-TEMPERATURE SELF-COMBUSTION OF HYDROCARBONS

Moscow KHIMICHESKAYA FIZIKA in Russian Vol 6, No 2, Feb 87  
(manuscript received 12 Mar 86) pp 262-271

[Article by A. A. Borisov, V. M. Zamanskiy, V. V. Lisyanskiy, G. I. Skachkov and K. Ya. Troshin, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] A quantitative study of possible mechanisms of promotion and the effect of different types of promoters on high-temperature self-combustion of hydrocarbons considered different schemes of promotion and provided numerical solutions of a direct kinetic problem for promotion of  $\text{CH}_4$  combustion with consideration of an 8-stage scheme and different mechanisms of the effect of additives. A set of parameters was found which makes it possible to model  $\text{CH}_4\text{-O}_2$  self-combustion in a wide range of temperatures and concentrations of the initial components. The effectiveness of different types of promoters as a function of temperature, reaction rates of the promoter and its concentration was determined. The method can be used to theoretically assess and predict the effectiveness of the promoter by its kinetic parameters and to select promoters which are effective in accelerating self-combustion by hydrocarbons. Figures 4; references 25: 9 Russian, 16 Western.

2791/9835

CSO: 1841/276



# DETERMINATION OF PROMOTING EFFECT OF GERMANIUM HYDRIDE DURING METHANE COMBUSTION AND HIGH TEMPERATURE REACTIONS OF $\text{CH}_3$ RADICAL

Moscow KHIMICHESKAYA FIZIKA in Russian Vol 6, No 2, Feb 87  
(manuscript received 3 Dec 85) pp 272-277

[Article by A. M. Vashchenko, I. S. Zaslanko, A. B. Zborovskiy, Yu. P. Petrov, V. N. Smirnov, A. M. Tereza, A. N. Tyurin and S. A. Tsyganov, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] The promoting action of  $\text{GeH}_4$  was measured in shock waves in order to record the accumulation and expenditure of  $\text{CH}_3$  radicals during  $\text{CH}_4$  combustion, promoted or unpromoted by azamethane additives at 1330-2040°K, and the kinetics of promotion were determined. Experiments were performed in a stainless steel 75 mm shock tube with measurement of  $\text{CH}_3$  and  $\text{O}_2$  absorption in the 2160 Å region and OH absorption in the 3068 Å region. Results clearly showed the potent effect of germanium hydride on this system and provided a basis for kinetic analysis of the mechanism of interaction of both  $\text{GeH}_4$  and other hydride promoters with this system. Measurement of the reaction rate of interaction of  $\text{CH}_3$  and atomic oxygen during simultaneous rapid disintegration of  $(\text{CH}_3)_2\text{N}_2$  and  $\text{GeH}_4$  in the presence of small amounts of  $\text{O}_2$  at 1660-2100 °K is discussed. Figures 4; references 22: 5 Russian, 17 Western.

2791/9835  
CSO: 1841/276

# CRITICAL PHENOMENA DURING FRACTURE OF SOLIDS AT HIGH PRESSURE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 292, No 4, Feb 87  
(manuscript received 22 Sep 86) pp 887-890

[Article by N. S. Yenikolopyan, academician, A. A. Mkhitaryan, A. S. Karagezyan and A. A. Khzardzhyan, Institute of Synthetic Polymers, USSR Academy of Sciences, Moscow; Yerevan Zootechnical Veterinary Institute]

[Abstract] A study of the dependence of fracture on the geometric dimensions of a sample used cardboard dieplates with diameter kept constant while varying the thickness and thickness kept constant while varying the diameter. The powder studied was pressed into the dieplates and placed between Bridgman anvils after determining that the dieplates do not fracture at maximum pressures (2.5-5.3 GPa). There was a critical pressure, differing for different substances, at which fracture occurred without additional shear deformation. The thicker the pellet layer, the lower the critical pressure of fracture. There was a critical pellet thickness below which simple uniaxial compression (maximum pressure near 3 GPa) did not produce fracture but



additional shear deformation applied above or below this thickness did produce fracture. There was a critical thickness below which the sample did not fracture even under very high shear deformation and compression. Under uniaxial compression, the critical thickness of the pellet depended upon its diameter. Fracture did not occur (at the pressure studied) when the weight of the pellet was less than 160-200 mg. The fracture of the solid under high pressure and shear deformation was characterized by a critical pressure, a critical deformation, a critical thickness and a critical coefficient of extrusion. These parameters are interdependent. Figures 3; references 7: 4 Russian, 3 Western.

2791/9835

CSO: 1841/235

UDC 541(15+64)

#### BUTADIENE-ACRYLONITRILE RUBBER EFFECTS IN RADIOPOLYMERIZATION OF HEPTYL METHACRYLATE

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 29, No 4, Apr 87  
(manuscript received 14 Aug 85) pp 703-708

[Article by D.P. Kiryukhin, A.I. Bolshakov and I.M. Barkalov, Department of the Institute of Chemical Physics, USSR Academy of Sciences]

[Abstract] An analysis was conducted on gamma-mediated radiopolymerization of heptyl methacrylate (HM) in relation to butadiene-acrylonitrile rubber (SKN-18) concentration in the system. Addition of SKN-18 reduced the initial rate of polymerization. However, with increasing concentrations of SKN-18 viscosity-dependent autocatalysis set in for polymerization. With ca. 60 wt% SKN-18, the viscosity is sufficient for virtually instantaneous autocatalytic polymerization, with the entire process simulating gel-effect conditions. Maximum rate for the polymerization decreases with increasing levels of SKN-18 in the system. The polymeric chains showed mixed-type of breakage, while, in the terminal stages of postpolymerization at 295 K, linear breakage predominates. The that stage HM undergoes grafting on SK-18. The rate constant for the growth of the polymer at 170-180 K was determined as equal to  $2 \times 10^{-13} \exp(-6000/RT)$  cm<sup>3</sup>/sec. Addition of small concentrations of the cross-linking agent, ethylene glycol monomethacrylate, enhanced the rate of polymerization. Figures 5; references 5: 4 Russian, 1 Western.

12172/9835

CSO: 1841/385

UDC 628.162.8

OXIDATIVE DESTRUCTION OF UREA DERIVATIVE PESTICIDES

Kiev KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 9, No 2, Mar Apr 87  
(manuscript received 10 Oct 85) pp 145-147

[Article by L. V. Konyk, P. N. Taran and M. A. Shevchenko, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, UkSSR Academy of Sciences, Kiev]

[Abstract] Wide use of phenylureas in clearing canals and irrigation ditches contaminates natural water resources and the available purification methods are not very effective. An attempt was made to use strong oxidizing agents (chlorine and ozone) for this purpose, studying phenuron, diuron and linuron as the representative phenylureas. Chlorine is normally used for decontamination purposes but the process is long lasting and not suitable for preparation of potable water. Ozone coupled with charcoal filtration was selected as the reagent of choice. Experimentally, it was shown that it leads to excellent quality of drinking water, good color and no odor. In general, when applied to chemical industry effluent, either chlorine or ozone could be used, depending on the composition and the end-points of the purification. References 15 (Russian).

7813/9835

CSO: 1841/381

REDUCTION OF Cr(VI) IN PRESENCE OF HEAVY METALS WITH AEROMONAS DECHROMATICA KC-II CULTURES

Kiev KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 9, No 2, Mar Apr 87

(manuscript received 12 Jun 85) pp 159-162

[Article by Ye. I. Kvasnikov, N. S. Serpokrylov, T. M. Klyushnikova, T. P. Kasatkina and L. L. Tokareva, Institute of Microbiology and Virology imeni D. K. Zabolotnyy, UkSSR Academy of Sciences, Kiev; Novocherkassk Polytechnic Institute]

[Abstract] Effluents of machine, automobile and various technical equipment factories contain Cr(VI) and heavy metal ions. In ionic form, they are more toxic towards microorganisms than in the form of their hydroxides. Some microorganisms are capable of destroying individual metals in small concentrations. In the present work, *Aeromonas dechromatica* was studied as an agent for purifying industrial effluent of Cr(VI). The effect of concentration, chemical form (ion or hydroxide) and presence of other heavy metal ions on the conversion of Cr(VI) to Cr(III) was evaluated. Regression analysis equations were developed for iron (concentration of Fe(III) and Fe(OH)<sub>3</sub> should be kept low), zinc (presence of Zn<sup>++</sup> or Zn(OH)<sub>2</sub> in effluent presents no problem), cadmium (no effect on the reduction of Cr(VI) by either form), nickel (its concentration should be lowered for both the ionic and hydroxyl forms), copper (Cu(OH)<sub>2</sub> content should be increased while decreasing Cu<sup>++</sup> concentration). These observations should help in developing measures for the preparation of effluents prior to exposing them to bioreagent purification. References 8: 7 Russian, 1 Western.

7813/9835

CSO: 1841/381

UDC 628.061.4

POLLUTION MONITORING-86 INTERNATIONAL EXPOSITION

Moscow KHIMICHESKIYE VOLOKNA in Russian No 2, Mar Apr 87 pp 60-61

[Article by I. N. Tananaina]

[Abstract] The international exhibition "Pollution Monitoring-86" was held 26 November-5 December 1986 with the cooperation of "Ekspotsentr" All-Union Society of the USSR Trade-Industry Board in Moscow. Exhibits of 34 foreign firms illustrated scientific and technical progress in the area of environmental protection. Installations and equipment designed for treatment and purification of waste water and gas, utilization of solid and liquid wastes, various instruments analyzing the status of the environment, laboratory equipment, optical and electronic computer equipment was exhibited. Hungarian, West German, US, Swedish and Japanese firms participated.

6508/9835

CSO: 1841/373

UDC 531.215

INFLUENCE OF ACTIVE EFFECTS ON PHASE COMPOSITION OF SURFACE OF EPITAXIAL FILMS OF  $\text{Cd}_x\text{Hg}_{1-x}\text{Te}$

Moscow POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA in Russian No 3, Mar 87  
(manuscript received 2 Apr 86) pp 54-59

[Article by B. A. Nesterenko, V. V. Milenin, O. Yu. Gorkun, V. G. Savitskiy, L. G. Mansurov and I. Z. Malinich, Institute of Semiconductors, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] The purpose of this work was to study the chemical composition of the surface of epitaxial films of  $\text{Cd}_x\text{Hg}_{1-x}\text{Te}$  (KRT) subjected to heat treatment and ion bombardment, and to study the interaction of water vapor with the atomically pure surfaces of these compounds. Experiments were conducted by x-ray photoelectronic spectroscopy. A chemically-heterogeneous phase about 50Å thick was found to form on the natural surfaces of epitaxial KRT films obtained by condensation in a high frequency mercury discharge, including in the composition of the film as major components a solid solution and oxides. The stoichiometric relationship of Cd, Sg and Te in the surface area differs from the mean value through the thickness of the film in the direction of higher mercury content. Heat treatment at up to 118°C results in a dome-shaped variation of mercury concentration in a layer about 30Å thick, with little change in Cd and Te concentration. Adsorption of water vapor on the (110) surface, purified by argon bombardment, is accompanied by dissociation of  $\text{H}_2\text{O}$  molecules with subsequent chemical bonding of the hydroxyl ions to the adsorption centers. Figures 4; references 11: 5 Russian, 6 Western.

6508/9835

CSO: 1841/318

INTERACTION OF INTERMETALLIC  $\text{ScFe}_2$  COMPOUNDS, ALLOYED BY YTTRIUM, RUTHENIUM AND GALLIUM WITH NITROGEN IN PRESENCE OF HYDROGEN

Leningrad ZHURNAL OBSHCHEY KHIM. I in Russian Vol 57, No 1, Jan 87  
(manuscript received 20 Feb 86) pp 73-79

[Article by K. N. Semenenko, S. P. Shilkin, V. V. Burnasheva, L. S. Volkova and N. G. Mozgina, Institute of New Chemical Problems, USSR Academy of Sciences, Chernogolovka]

[Abstract] Results of a study of the interaction of intermetallic compounds  $\text{Sc}_{0.9}\text{Y}_{0.1}\text{Fe}_2$ ,  $\text{Sc}_{0.5}\text{Y}_{0.5}\text{Fe}_2$ ,  $\text{ScFe}_{1.85}\text{Ga}_{0.15}$ ,  $\text{ScFe}_{1.7}\text{Ga}_{0.3}$  and  $\text{ScFe}_{1.5}\text{Ru}_{0.5}$  with nitrogen in the presence of hydrogen showed the end products of interaction of these intermetallides and their hydride phases with a nitrogen-hydrogen mixture under pressure up to  $10^7$  Pa and temperatures of 723-823°K to be phases of transition metals and scandium and yttrium nitrides. Figure 1; references 5 (Russian).

2791/9835  
CSO: 1841/281

CHEMICAL-MECHANICAL POLISHING AND STUDY OF SURFACE OF  $\text{PbSe}_{1-x}\text{Te}_x$  SINGLE CRYSTALS

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA 2, KHIMIYA in Russian Vol 27, No 6, Nov Dec 86 pp 571-574

[Article by O. N. Krylyuk, A. M. Gaskov and V. P. Zlomanov, Chair of Inorganic Chemistry]

[Abstract] The lead selenide and telluride solid solution  $\text{PbSe}_{0.08}\text{Te}_{0.92}$  may be used as substrate material in epitaxial heterostructures of  $\text{Pb}_{0.8}\text{Sn}_{0.2}\text{Te-PbSe}_{0.08}\text{Te}_{0.92}$  which agree in crystal lattice parameters. Surface perfection of the epitaxial layer and uniformity of composition throughout its thickness are to a great extent determined by the quality of the substrate material, especially composition and surface perfection. In order to obtain high quality solid solution surfaces suitable for subsequent epitaxy, a previously developed method of chemical and mechanical polishing with aqueous solutions of potassium hexacyanoferrate, glycerine and sodium hydroxide was selected in the present work. This method was used to prepare the surface of  $\text{PbSe}_{0.08}\text{Te}_{0.92}$ . The root-mean-square profile height of the treated surface was 160-240 Ång. units and 35-55 angular seconds half-width in oscillation curves. The thickness of the damaged layer in crystals resulting from cutting with a diamond-edged disc was determined to be 300 microns. Auger-electron spectroscopy was used to demonstrate that the surfaces of the crystals become enriched with tellurium after chemical and mechanical polishing. Figures 3; references 11: 3 Russian, 8 Western.

2791/9835  
CSO: 1841/281



GLASS FORMATION AND PROPERTIES OF GLASSES IN SYSTEM  $V_2O_5-B_2O_3-P_2O_5$ 

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR: SERIYA KHIMICHESKAYA  
in Russian No 1, Jan Feb 87 (manuscript received 9 Jun 86) pp 24-28

[Article by G. P. Dedmale, Ya. A. Vayvad. S. Ye. Arkhipova and  
L. A. Laukmanis, Riga Polytechnic Institute imeni A. Ya. Pelshe]

[Abstract] Systematic studies of glass formation and the physical-chemical properties of glasses in the system  $V_2O_5-B_2O_3-P_2O_5$  were conducted in order to produce amorphous semiconductor elements for electronics or coatings with extremely low melting points. Methods of mathematical experimental planning and standard methods of investigation of the properties of glasses were used. The area of glass formation in the system was found to be limited by the following ranges of molar fractions of the components, in percent:  $V_2O_5$  30-80,  $B_2O_3$  0-45,  $P_2O_5$  20-65. Chemical stability of glasses depends nonlinearly on  $V_2O_5$  content as a result of its transition at 45-50% content from the position of a modifier to the position of a glass former. Linear dependence of density on  $V_2O_5$  and  $B_2O_3$  content shows that vanadium and boron do not change their degree of coordination in these glasses. Electron conductivity is most characteristic for these glasses, particularly after heat treatment of glasses with 60-70 mol.%  $V_2O_5$ , in which  $\rho_{V_{200}^\circ} = 10^2-10^3$  Lhm·m. Figures 4; references 4 (Russian).

6508/9835

CSO: 1841/309

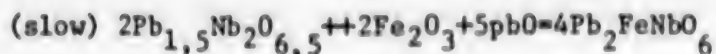
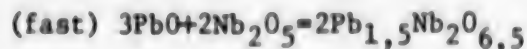
## PRODUCTION OF LEAD FERRONIObATE IN PRESENCE OF POTASSIUM AND SODIUM CHLORIDE MELT

Moscow ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 32, No 4, Apr 87  
(manuscript received 19 Jul 85) pp 865-868

[Article by S. S. Lopatin, T. G. Lupeyko, and T. I. Ivleva, Rostov State  
University imeni M. A. Suslov]

[Abstract] Solid solutions of lead ferroniobate ( $Pb_2FeNbO_6$ ) are widely used to manufacture multilayer ceramic condensers and piezoelectric converters, and the substance can be used in magnetoelectric converters due to its ferroelectric and antiferromagnetic properties. This article studies the kinetics and mechanism of formation of lead ferroniobate from simple oxides in the presence of a melt consisting of an equimolar mixture of sodium and potassium chlorides. The synthesis occurs under these conditions at approximately 200°C lower temperature than in the solid-phase method. Interaction of the simple

oxides occurs in two stages:



whereas without the addition of the flux it occurs through the formation of many intermediate compounds. The particles of the product produced have similar dimensions, which is important for sintering of high quality ceramics. Figures 4; references 10: 5 Russian, 5 Western.

6508/9835

CSO: 1841/347

UDC 548.73;548.5:537.3-1.33

#### SYNTHESIS AND X-RAY STUDY OF ALUMINUM IODATE OCTAHYDRATE CRYSTALS

Moscow ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 32, No 4, Apr 87  
(manuscript received 14 Feb 86) pp 869-875

[Article by O. G. Potapova, T. M. Polyanskaya, K. I. Avdiyenko, B. I. Kidyarov, and I. V. Nikolayev, Institute of Inorganic Chemistry, Siberian Department, USSR Academy of Sciences; Institute of Semiconductor Physics, SD, USSR AS; Institute of Thermal Physics, SD, USSR AS]

[Abstract] Crystals of  $\text{Al}(\text{IO}_3)_3 \cdot 8\text{H}_2\text{O}$  are of interest for use in nonlinear optics, acoustoelectronics and acousticoptics. This article discusses the synthesis of single crystals, determines the chemical formula of aluminum iodate crystal hydrate, refines the parameters of the unit cell and presents powdergrams of the compound. Aluminum hydroxide for synthesis was obtained by precipitation with lithium hydroxide from aluminum nitrate or sulfate solutions. The content of iodate in the crystals was determined by titration with sodium thiosulfate dissolved in water. Thermal analysis and IR spectral studies were performed. Freshly prepared aluminum iodate powder was the hexahydrate, while after storage it was converted to the octahydrate. The octahydrate manifests monohedric symmetry, but forms are also observed characteristic of monoclinic structure axial symmetry. The octahydrate shows a great tendency toward twinning, indicating sources of internal stress such as the formation of crystals of solid solutions with varying content of water of crystallization or the formation of solid solutions of aluminum iodate with iodic acid in the area of  $\text{HIO}_3$  microcontent as is observed in the crystallization of lithium iodate. Further studies must be performed with perfect octahydrate crystals with low defect density. Figures 3; references 12: 10 Russian, 2 Western.

6508/9835

CSO: 1841/347

$\text{La}_2\text{S}_3 - \text{La}_2\text{O}_3 - \text{Ga}_2\text{S}_3$  SYSTEM

Moscow ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 32, No 4, Apr 87  
(manuscript received 28 May 85) pp 1016-1021

[Article by I. B. Bakhtiyarov and P. G. Rustamov, Institute of Inorganic and Physical Chemistry, AzSSR Academy of Sciences]

[Abstract] This article discusses phase equilibria and constructs the liquidus surface of the ternary system  $\text{La}_2\text{S}_3 - \text{La}_2\text{O}_3 - \text{Ga}_2\text{S}_3$ . Studies were performed by differential thermal analysis, high temperature differential thermal analysis, x-ray phase analysis, microstructural analysis and thermodynamic analysis. The projection of the liquidus surface is constructed for the first time. Areas of primary crystallization of the phases are established, as well as the coordinates of all iono- and monovariant equilibria. Figures 3; references 16: 8 Russian, 8 Western.

6508/9835  
CSO: 1841/347

## KINETICS OF SILICON DIOXIDE ETCHING IN GASEOUS HYDROGEN FLUORIDE

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIYE NAUKI in Russian Vol 2, No 1, Jan 87  
(manuscript received 18 Sep 85) pp 25-29

[Article by M. R. Baklanov, F. N. Dultsev and K. P. Mogilnikov, Institute of Semi-conductor Physics, Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Abstract] A study of the kinetics of interaction of gaseous hydrogen fluoride and layers of silicon dioxide, synthesized under different experimental conditions, is described and discussed and a kinetic model of the process is analyzed. Examination of the process of etching of silicon dioxide layers in hydrogen fluoride vapors as a function of the hydrogen fluoride concentration, temperature of synthesis of the silicon dioxide layers and temperature of the samples showed that the process is catalyzed by water, forming as a result of the reaction. Reduction of the temperature of synthesis of the silicon dioxide layers increased the concentration of the centers which are active in relation to the hydrogen fluoride. Figures 4; references 5: 3 Russian, 2 Western.

2791/9835  
CSO: 1841/277

## CHEMICAL EQUILIBRIA IN GASEOUS PHASE OF In-I SYSTEM

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIYE NAUKI in Russian Vol 2, No 1, Jan 87 (manuscript received 10 Sep 85) pp 75-81

[Article by V. A. Titov, T. P. Chusova and G. A. Kokovin, deceased, Institute of Inorganic Chemistry, Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Abstract] The P-T-x-dependence of unsaturated vapor in an In-I system was studied by a statistical method in 10 series of experiments in a wide range of temperature, composition and pressure by use of membrane null-pressure gauges. Thermodynamic properties of gaseous  $\text{InI}_3$ ,  $\text{In}_2\text{I}_6$ ,  $\text{In}_2\text{I}_4$  were calculated. Figures 2; references 16: 12 Russian, 4 Western.

2791/9835  
CSO: 1841/277

## PHOTOELECTRIC AND FLUORESCENT CHARACTERISTICS OF DOPED GaP CRYSTALS

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 2, Mar Apr 87 (manuscript received 16 Nov 85) pp 81-83

[Article by Ya. Agayev, G. Garyagdyeyev, A. Annayev and V. G. Makarenko, Turkmen Polytechnical Institute]

[Abstract] Importance of GaP in optoelectronics in the production of high-resistance converters and detectors functional in the visible and ultraviolet parts of the spectrum led to a study of the photoconductivity and fluorescent parameters of doped GaP crystals. Studies were conducted on undoped and on samples doped with oxygen, Zn or Yb. Graphical data are presented for p-, n-, and p-n type supports, depicting the spectral distributions of the photocurrents, photoluminescence, and photosensitivity of epitaxial GaP films at 77 and 300 K. Maximum photoconductivity at room temperature was noted at 0.46  $\mu\text{m}$  (2.68 eV), which corresponded to direct optical transitions in GaP. On cooling, the maximum shifted to a shorter wavelength at a rate equal to the temperature coefficient of the width of the forbidden zone for GaP. Retention of photosensitivity at room temperatures points to the utility of GaP as a material for photoresistors in the ultraviolet range. Figures 2; references 10: 9 Russian, 1 Western.

12172/9835  
CSO: 1841/382



## EFFECTS OF CONDUCTIVITY OF SEMICONDUCTOR COMPONENT ON RESONANT MAGNETORESISTANCE CURVES

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian  
No 2, Mar Apr 87 (manuscript received 13 Feb 85) pp 85-88

[Article by T. D. Aliyev, I. M. Zakharova and V. I. Zubkov, Physicotechnic Institute, Turkmen SSR Academy of Sciences]

[Abstract] An analysis was conducted on the peaks of the magnetostrictive waves and emf of Fe-Yt garnet films with p-InSb films, separated by 10-15  $\mu$ m Teflon films, to assess the effects of semiconductor conductivity on resonant magnetoresistance curves. Analysis of the peaks demonstrated that the presence of the semiconductor component resulted in a shift of the magnetostrictive peaks to higher frequencies, with the shift at the garnet-air interface being significantly more pronounced than at the garnet-support interface. The semiconductor also affected the shape of the magnetoconstrictive waves, leading to broadening and a reduction in the amplitude. The highest emf values applied to the most pronounced magnetostrictive peaks of the garnet film that underwent the greatest shift on approximation of the semiconductor film. Figures 2; references 9: 8 Russian, 1 Western.

12172/9835  
CSO: 1841/382

UDC 546./831/.682:541.165:537.311

EUTECTOIDAL BREAKDOWN OF SOLID SOLUTIONS IN SYSTEM  $ZrO_2$ - $In_2O_3$  AND ELECTRICAL PROPERTIES

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 59, No 11, Nov 86  
(manuscript received 24 Oct 85) pp 2454-2457

[Article by L. V. Morozova, V. P. Popov, P. A. Tikhonov and V. B. Glushkova]

[Abstract] Previous studies show that in the title system there are two eutectoidal points in the sub-solidus region corresponding to solid solution breakdown of tetrahedral and cubic structures of the fluorite type. It is impossible to predict the kinetic stability of fluorite type solid solutions below the eutectic temperature from phase diagram data, although these data are of both theoretical and practical interest. In the present work a study was made of the kinetics of concentration and structure changes as well as the electrical properties during breakdown of fluorite-type solid solutions in the title system. Samples containing 10-20 mole % indium oxide were fired at 1650 deg for one hour, calcined in air and subjected to phase analysis by X-ray. The samples were then maintained isothermally at 1100 deg (150 deg below the eutectic point) for various intervals of time. The results show



that conductivity of the solid solution  $(\text{ZrO}_2)_{0.8}(\text{In}_2\text{O}_3)_{0.1}$  changes markedly over several orders of magnitude from ionic to a purely n-type electronic, depending on the calcining time. Breakdown of the solid solution zirconium oxide (0.8)-indium oxide (0.2) differs by changing into a two-phase structure after the first 20 hours calcining and the appearance of monoclinic zirconium oxide after the next 20 hours. Evidently, eutectoidal breakdown of the title solid solution takes place in the following order: 1) initial emergence of stabilizing indium oxide on the grain boundary of the initial phase; 2) rearrangement of indium and zirconium oxide concentrations in the initial fluorite phase forming macroscopic variations in concentration; 3) phase transformations and increase in concentration differences, emergence of new phases with changes in properties of the material; 4) further redistribution of concentrations between the zirconium oxide phase and that based on the volume-centered cubic indium oxide, reaching equilibrium status. This process may last for hundreds of hours even at temperatures above 1000 deg. Eutectoidal breakdown must be considered when predicting long-term work on high melting electrically conducting materials, especially those based on zirconium and hafnium oxides. Figures 5; references 5: 3 Russian, 2 Western.

12765/9835

CSO: 1841/215

UDC 541.138

# ANODE DISSOLUTION OF COBALT SILICIDE SINGLE CRYSTALS IN SULFURIC ACID ELECTROLYTE, CONTAINING HALIDE IONS

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 59, No 11, Nov 86  
(manuscript received 28 Oct 85) pp 2448-2550

[Article by A. B. Shein, Perm State University imeni A. M. Gorkiy]

[Abstract] Silicides of transitional 3-d metals are widely used in deoxidizing and alloying steel, as components in chemical syntheses and to produce acid-resistant materials. Severe conditions, such as corrosive media, require reliable data on corrosion and electrochemical behavior of these metal silicides. In the present work results are presented on a study of the anode dissolution process on single crystals of cobalt silicide in sulfuric acid electrolyte containing halide ions, since it has been demonstrated previously that the latter may determine both the mechanism and the kinetics of anode dissolution of silicon-containing alloys. Single crystal electrodes were encased in teflon leaving a working face open. Crystal face orientation was controlled before and after each experiment by X-ray structure analysis. Each electrode was first polished, de-greased and loaded into a chlorate-acetate electrolyte, removed, washed with double distilled water and placed into a cell containing 1N sulfuric acid. Anode polarization curves were then recorded. The results indicate that CoSi is highly resistant to acid corrosion and that the mechanism and kinetics of CoSi dissolution in sulfuric acid electrolyte is determined by the non-metallic component--silicon.

Crystallographic orientation of the single crystal greatly affects the kinetics of the anode reaction, but not the mechanism. The effects of halide ions are not uniform, but in general they facilitate breakdown of the passive film accelerate dissolution of cobalt silicide. Figure 1; references 10: 7 Russian, 3 Western.

12765/9835  
CSO: 1841/215

UDC 548.54

# HYDROTHERMAL CHEMISTRY OF GALLIUM ALPHA-ORTHOPHOSPHATE IN ORTHOPHOSPHORIC ACID

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 292, No 4, Feb 87  
(manuscript received 19 Feb 86) pp 876-878

[Article by A. A. Adkhamov, academician, TadSSR Academy of Sciences, B. S. Umarov, A. B. Ilyayev, V. I. Popolitov, I. M. Yaroslavskiy and B. N. Litvin, Institute of Crystallography imeni A. V. Shubnikov, Moscow; Physico-technical Institute imeni S. U. Umarov, TadSSR Academy of Sciences, Dushanbe]

[Abstract] Results of a study of solubility of  $\alpha$ -GaPO<sub>4</sub>, its recrystallization in ortho-phosphoric acid and the morphology of the crystals obtained are described and discussed. Solubility of  $\alpha$ -GaPO<sub>4</sub> was studied by weight loss at temperatures above 500°C. The dependence of solubility of gallium orthophosphate on temperature has a complex nature, consisting of three parts: an interval of retrograde solubility up to 360°C, an interval of 360-400°C in which solubility is scarcely dependent on temperature and an interval of 400°C above which solubility increases. The dependence of solubility on orthophosphoric acid concentration was linear. Optimum conditions for recrystallization of gallium orthophosphate are: 280°C, orthophosphoric acid concentration 9.5 M and temperature differential of 50°C. In a stationary regime, 3-5 mm crystals formed in the course of 300-400 hours with formation of 2 habit types: crystals with uniformly or almost uniformly developed faces of positive and negative single rhombohedrons and crystals with predominant development of faces of a positive, single rhombohedron. Figures 3; references 9: 2 Russian, 7 Western.

2791/9835  
CSO: 1841/285

UDC 620.181:537.228

ANISOTROPY OF ELASTIC WAVE PROPAGATION IN PYRARGYRITE AND PROUSTITE CRYSTALS

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIIKH NAUK in Russian No 2, Mar Apr 87 (manuscript received 6 Mar 85) pp 76-81

[Article by Ya. A. Agayev, G. Garyagdyev, Ya. M. Olikh, B. Ye. Tsekvava and K. S. Sukhanov, Turkmen State University]

[Abstract] In view of the importance of single pyrargyrite ( $\text{Ag}_2\text{SbS}_3$ ) and proustite ( $\text{Ag}_3\text{AsS}_3$ ) crystals in nonlinear optics and acoustic electronics, a study was conducted on the anisotropy of elastic wave dissemination in relation to various parameters. To that end, phase velocities were analyzed in relation to electromechanical factors and polarization under conditions when residual conduction could be ignored. In conjunction with published data on the physical characteristics of pyrargyrite and proustite, calculations were made of the angular relationships of velocity, vector of polarization and the electromechanical coefficient for crystallographic planes (0001), (1010), and (1120). In propagation of the elastic waves in the XY plane, the coefficient of electromechanical relationship for pyrargyrite and proustite were similar. However, they differed significantly in planes XZ and YZ. The latter was due to marked differences in the piezoelectric coefficients of pyrargyrite and proustite. Maximum values for the electromechanical coefficient were obtained in the Y plane of symmetry. Figures 3; references 5: 4 Russian, 1 Western.

12172/9835  
CSO: 1841/382

## ABSORPTION SPECTRA OF Cr-DOPED InP

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 2, Mar Apr 87 (manuscript received 18 Nov 85) pp 83-84

[Article by K. B. Sadykov, N. G. Bekmedova, O. Ismailova and Ya. Agayev, Physicotechnic Institute, Turkmen SSR Academy of Sciences]

[Abstract] In view of their use in electronic devices, absorption spectra were analyzed for Cr-doped InP in the 0.5-1.2 eV region. Using samples with a carrier concentration of  $n = 1.5 \times 10^{17} \text{ cm}^{-3}$  and a mobility of  $980 \text{ cm}^2/\text{V}\cdot\text{sec}$ , and  $n = 2 \times 10^{18} \text{ cm}^{-3}$  and  $400 \text{ cm}^2/\text{V}\cdot\text{sec}$ , led to the detection of three maxima at 0.86, 0.95 and 0.99 eV. Comparison with the data for undoped samples led to the conclusion that the maximum at 0.86 eV could be attributed to O-Cr complex, and at 0.95 eV to Cr-(3d<sup>4</sup>) transition. Figure 1; references 10: 8 Russian, 2 Western.

12172/9835  
CSO: 1841/382

CRYSTAL STRUCTURE OF DEYVITE  $\text{Yb}_2[\text{Si}_2\text{O}_7]$ 

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 291, No 4, Dec 86 (manuscript received 19 Nov 85) pp 863-867

[Article by O. V. Yakubovich, M. A. Simonov, A. V. Voloshin and Ya. A. Pakhomovskiy, Moscow State University imeni M. V. Lomonosov; Geological Institute Kola Branch imeni S. M. Kirov, USSR Academy of Sciences, Apatity]

[Abstract] A new Yb-silicate, keyvite, was discovered in amazonite pegmatites of the Kola Peninsula. It forms elongated laminar crystals 0.1-0.8 mm in length and concretion, frequently oriented along fissures in fluorite. The crystals are colorless with a glassy luster and are characterized by perfected cleavages along the prism (011), and non-perfected along (100). Polysynthetic twinning is characteristic. The mineral is optically bi-axial, negative rotation. Idealized composition is according to the title. Full X-ray structural analysis of the mineral was made on a crystal fragment 0.01 mm. Nucleus parameters were determined on an automatic quadra-rotational diffractometer. Reflection intensities in structural amplitudes and all subsequent calculations were conducted on the INTEXTL program. Other crystallographic characteristics, coordinates of basic atoms with temperature factors and interatomic distances are presented. References 12: 8 Russian, 4 Western.

12765/9835  
CSO: 1841/210

7-AMINOCOUMARINS (LITERATURE REVIEW)

Riga KHIMIYA GETEROTSIKlicheskih SOYEDINENIY in Russian No 2, Feb 87  
(manuscript received 26 Nov 84) pp 147-174

[Article by I. I. Grandberg, L. K. Denisov and O. A. Popova, Moscow  
Agricultural Academy imeni K. A. Timiryazev]

[Abstract] Largely Western literature is reviewed on the 7-aminocoumarins, concentrating on those with potential for use in lasers. The topics covered in the review include synthetic methods, such as reduction of 7-nitro coumarins, cyclocondensation of 4-aminosalicylic aldehydes with acetic acid derivatives and their functional derivatives, the von Pechmann reaction and so forth. Coverage is also accorded to reactivity of the various 7-aminocoumarins (bromination, nitration, arylation etc.), and the electronic absorption and emission spectra. References 238: 17 Russian, 221 Western.

12172/9835  
CSO: 1841/317



UDC 547.72:547.245::539.27

HETEROORGANIC DERIVATIVES OF FURAN. PART 62: MOLECULAR STRUCTURE AND REACTIVITY OF 2-FURYLHYDROSILANES

Riga KHIMIYA GETEROTSIKLICHESKIKH SOYEDINENIY in Russian No 1, Jan 87  
(manuscript received 11 Jul 86) pp 25-30

[Article by N. P. Yerchak, R. N. Ziatdinova, O. A. Litvinov, V. A. Naumov and E. Lukevits, Institute of Organic Synthesis, Latvian SSR Academy of Sciences, Riga; Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Affiliate, USSR Academy of Sciences, Kazan]

[Abstract] For the first time, tri(2-furyl)silane has been synthesized from 2-furylhydrosilanes. The unusual reactivity of the compound in hydrosilylation and dehydrocondensation reactions immediately attracted attention. Hydrosilylation of 1-vinylsilatrane by tri(2-furyl)silane begins at room temperature, and its autocatalytic dehydrocondensation with amino alcohols occurs too rapidly to measure. Autocatalytic dehydrocondensation of triorganyl hydrosilanes with amino alcohols and the reaction of hydrosilylation of unsaturated compounds occur at lower speeds or under more severe conditions for other triorganyl hydrosilanes. The noncatalytic reaction of dehydrocondensation with water has been observed only for 2-furylhydrosilanes. It has been shown that di-2(furyl)silane undergoes dehydrocondensation with ethanol with no catalyst when the reagents are boiled in an atmosphere of argon. Tri(2-furyl)silane and 2-furylsilane do not react with alcohol under these conditions. Gas electronography is used to study the structure of the molecules of 2-furyl-, di(2-furyl) and tri(2-furyl)silane. Figures 2; references 29: 10 Russian, 19 Western.

6508/9835  
CSO: 1841/311

## MULTISTAGE MECHANISM OF CONFORMATION TRANSITIONS IN METALLATRANES

Riga KHIMIYA GETEROTSIKLICHESKIKH SOYEDINENIY in Russian No 1, Jan 87  
(manuscript received 5 Mar 86) pp 129-133

[Article by E. L. Kupche, E. E. Liepinsh and E. Lukevits, Institute of  
Organic Synthesis, Latvian SSR Academy of Sciences, Riga]

[Abstract] A study is reported of the intramolecular dynamics of metallatranes, a transition class of compounds between derivatives of bicyclo [3.3.3] undecane and tricyclo [3.3.3.0] undecane. The constants of spin-spin interaction of protons in  $\text{OCH}_2\text{CH}_2\text{N}$  fragments of unbalanced metallatrane derivatives and two-dimensional NMR  $^1\text{H}$  spectra of one-substituted 3,6,10-trimethylsilatranes indicate a multistage exchange mechanism upon conformation transitions rather than synchronous conversion of metallatranes in solution. To seek additional demonstration of the multistage mechanism, the authors studied the structure of 1,3,7,10-tetramethylsilatrane and one-phenyl-3,7,10-trimethylsilatrane in solutions. Determination of a cross peak between spatially close protons in OCH of neighboring cycles unambiguously proves the existence of an RRS isomer of the two compounds, demonstrating that the conversion of metallatranes is a multistage rather than a synchronous mechanism. Figures 3; references 25: 10 Russian, 15 Western.

6508/9835  
CSO: 1841/311

UDC 547.979.733.04

## PORPHYRINS. PART 21. SYNTHESIS AND REACTIVITY OF 13,17-DISUBSTITUTED DERIVATIVES OF 13,17-DESETHYLETHIOPORPHYRIN-III

Riga KHIMIYA GETEROTSIKLICHESKIKH SOYEDINENIY in Russian No 2, Feb 87  
(manuscript received 21 Aug 85) pp 214-220

[Article by G. B. Maravin, G. V. Ponomarev and A. M. Shulga, Institute of  
Biophysics, USSR Ministry of Health, Moscow]

[Abstract] Description is provided for the synthesis of 2,7,12,18-tetramethyl-3,8-diethyl-13,17-di(3-hydroxypropyl)porphyrin from protohemin (I), by the reaction of I with  $\text{PBr}_3$  and  $\text{SOCl}_2$  to prepare 13,17-di(3-bromopropyl)- (II) and 13,17-di(chloropropyl)- (III) porphyrins. Reaction of II with sodium diethyl malonate resulted in the formation of 13,17-di(4,4-diethoxycarbonyl-butyl)porphyrin. Reaction of III with dimethylamine led to the synthesis of 13,17-di(3-N,N-dimethylaminopropyl)porphyrin and piperazine, diethanolamine, and imine diacetate ester. Aminopropylporphyrins were also synthesized by the reduction of mesoporphyrin-IV amides with dimethylamine, diethylamine,

piperidine and with morpholine. References 12: 5 Russian, 7 Western.

12172/9835  
CSO: 1841/317

UDC 621.319.2

EFFECT OF MICROSCOPIC STRUCTURE OF POLYORGANOSILSESQUIOXANES ON RELAXATION OF RADIATIONAL DISLOCATIONS IN STRONGLY NON-EQUILIBRIUM SYSTEM WITH MONOCRYSTALLINE SILICON

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 291, No 4, Dec 86  
(manuscript received 28 Jan 86) pp 904-907

[Article by V. N. Spektor and N. A. Senatova, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] A previously proposed hypothesis on the spiral structure of cyclo-spacial polyorganosilsesquioxane (POSSO) macromolecules has been confirmed. However, the cycle examined, within the framework of a copolymer model of POSSO structure, could only be one element of a polymer chain. In the present work the spiral structure of a cyclo-spacial chain was confirmed still further, as well as its effect on the nature of relaxation processes of mechanical stresses arising in the POSSO system on a monocrystalline silicon substrate under  $Ar^+$  ion bombardment. Oligomethylsilsesquioxane (OMSSO) was deposited on a previously cleaned substrate of monocrystalline silicon and cut along the 100 plane; the sample was dried in air for one hour and then placed under vacuum for ionic treatment and scanning microscopy. The angle of attack of the  $Ar^+$  ion was 90 deg at 4 Mev energy. The irradiation dosage varied from  $5 \times 10^{-4}$  to  $1 \times 10^{-3}$  Kl  $cm^{-2}$ . Eight types of radiation defects (RD) were observed in polymethylsilsesquioxane. Further research on the formation of microfissures as a function of the organic radical within the framework of a siloxane chain and the angle of attack of high energy ions may lead to quantitative relationships between various radiation defects and relaxation of radiation-stimulated stresses in POSSO systems - semiconductor single crystals. Figure 1.

12765/9835  
CSO: 1841/210

UDC 547.558.4

SYNTHESIS AND STUDY OF NEW COMPLEX BORON COMPOUNDS

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA KHIMICHNYKH NAVUK in Russian No 1, Jan Feb 87 (manuscript received 5 Oct 84) pp 116-118

[Article by V. I. Grachek, S. F. Naumova and I. V. Shelemova, Institute of Physico-Organic Chemistry, BSSR Academy of Sciences]

[Abstract] New complex compounds of boron were synthesized by interaction of boric acid and pyrocatechin and ligands having possibly one or several donor centers and the compounds were studied to determine their insecto-acaricidal, herbicidal and fungicidal activity and their capacity to regulate plant growth on standard test-objects. The compounds displayed practically no activity except a pronounced fungicidal effect. The most effective compounds were those containing a pyridine ring in their molecule. References 7: 5 Russian, 2 Western.

2791/9835  
CSO: 1841/275

UDC 632.952(047)

SYNTHESIS OF AZOLE SYSTEMIC FUNGICIDES

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 4, Apr 87 pp 202-206

[Article by N. N. Melnikov and I. M. Milenteyn]

[Abstract] This article briefly describes methods of synthesis of azole fungicides used in agriculture or presently in the experimental stage. Benzimidazole derivatives are not included, since they have been described in detail elsewhere. Creation of preparations meeting the requirements of today's agriculture requires multistage synthesis using various methods of precision organic chemistry. The higher cost and consumption of raw materials

involved in producing these fungicides are compensated by the lower doses and less frequent applications required to control plant fungus diseases. Products covered include flutrimazole, imazalyl, phenapanyl, etakonazole, paklobuturazole, dichlorobutrazole, S-3308, fluotriathol and DRKh N6573. References 37: 10 Russian, 27 Western.

6508/9835

CSO: 1841/380



COMPACT UNITS PRODUCE FUEL FOR DIESELS FROM CONDENSATE AT GAS FIELDS

Moscow IZVESTIYA in Russian 5 May 87 p 2

[Article by T. Fetisov]

[Excerpt] An article entitled "Another 'Occupation' for Condensate" (in IZVESTIYA, Nos. 221-222 for 1984) described work which scientists of the Tashkent Highway Institute, the Chelyabinsk Polytechnic Institute and a number of industry-affiliated scientific research institutes were doing. The main indices of a gas-condensate fuel which they developed for high-speed diesel engines are equal in every respect to those of standard diesel fuel, and some are superior. In the earlier article, the newspaper raised the question of expediting introduction of this scientific development. What has changed since then?

"Final results of tests of the new fuel have been confirmed since the IZVESTIYA article appeared," related E. Grushevenko, deputy head of a subdepartment of the USSR State Planning Committee. "Use of the fuel is now permitted at gas fields of West Siberia and the Far North, and also in Tashkent."

Use of the new fuel makes it possible to reduce exhaust-gas fumes by one-half, and carcinogenic emissions by one-half to two-thirds.

But the development and introduction of the gas-condensate fuel have taken rather a long time.

"I admit that it may seem too long," Grushevenko said. "But the fact that vehicles costing tens of billions of rubles are to be converted to the new type of fuel should be taken into account in this connection. In introducing gas-condensate fuel, there is a necessity for absolute assurance that it does not adversely affect the performance properties, reliability and durability of engines, or the safety of people."

"What, then, are the real prospects for its introduction?"

"It has already begun. The amount of diesel fuel being delivered to places such as Novyy Urengoy, Surgut and other gas fields has thus been substantially reduced. Let me point out that for the time-being, gas-condensate fuel will be produced and used chiefly at northern gas fields and in nearby areas that are difficult to reach."

The earlier article mentioned that two types of small units for producing fuel directly at gas fields had been designed at the All-Union Scientific Research Institute of Natural Gas (VNIIGaz). With the help of a number of design organizations, this institute has developed a whole series of similar units, which are capable of refining 4,000 to 50,000 tons of condensate a year. They are all simple, operate reliably, and can be delivered by any kind of transport.

The first two units with 50,000-ton capacities were introduced at the Urengoy Gas Field in 1985, and two more will go into operation there this year. About 15 such units are supposed to be operating in areas of the Komi ASSR, the Yamal Peninsula, the northern part of West Siberia, Yakutia and Central Asia by 1990. Plans call for series production of the units to be organized at plants of the Ministry of Chemical and Petroleum Machine Building.

I next spoke with Doctor of Technical Sciences, Professor A. Gritsenko, general director of the USSR Ministry of the Gas Industry's All-Union Gas Technology Research and Production Association.

"Are there any figures yet on savings resulting from introduction of gas-condensate fuel?"

"Last year, the real economic benefit from its use was more than 2 million rubles at Novyy Urengoy alone. Not all of the capabilities of gas condensate have been made evident as yet. That ordinary automotive fuel also can be made from it has been demonstrated, and confirmed in practice as well. VNIIGaz has experience with obtaining type A-76 gasoline from condensate. We are now conducting operational tests of it."

"What will use of the new fuel mean for the country's fuel balance?"

"It is difficult to cite a precise figure, since many factors are involved in its production. But I can say in any case that it may be a matter of hundreds of thousands of tons of extra fuel."

FTD/SNAP

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CSO: 1841/378

# IMPACT OF NEW ECONOMIC CONDITIONS ON 'KASPMORNEFTEGAZPROM' VPO

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 1, Jan 87 pp 7-10

[Article by K. A. Abasov, chairman, "Kaspmorneftegazprom" VPO [expansion unknown]]

[Abstract] With the development of the economic policies promulgated by the April 1985 CC CPSU Plenum the "Kaspmorneftegazprom" VPO has set the foundations for consistent progress in 1987. In comparison with 1985, oil production has increased by 199,000 tons, and gas production has exceeded planned figures by 65 million cubic meters. Labor productivity has increased by 100.6%, and residential areas have been developed on some 43.4 thousand square meters of land. However, despite the obvious successes, there are also areas of concern and problems that remain to be addressed. Exploratory drilling, for example, was 83.8% below the planned level in 1986. In addition, other shortcomings are evident in the transportation sector, ship maintenance and repair and new investments. Many of these problems may be rectified by direct and indirect approaches, such as pay based on initiative and actual accomplishment, and greater reliance on personal and collective initiative in solving problems.

12172/9835

CSO: 1841/325

UDC 541.15+553.061.3

# ROLE OF IONIZING RADIATION IN COALIFICATION OF ORGANIC MATTER IN NATURE

Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 21, No 1, Jan Feb 87  
(manuscript received 5 Aug 85) pp 45-49

[Article by V. M. Byakov, G. G. Pimenov and O. P. Stepanov, Institute of Theoretical and Experimental Physics]

[Abstract] Conventional theory of coal formation holds that organic matter, consisting originally of plant and animal residues containing the elements C, H, O, and N, underwent with time, an increase in carbon content and the

process is called coalification. Some of it, beginning with brown coal conversion into anthracite and graphite was named regional metamorphism, the latter being the result of subterranean heat. Although the effects of ionizing radiation from radioactive elements dispersed in the organic matter itself have been referred to in the literature, the subject was never examined as a basic factor. In the present work data are presented to support the fact that regional metamorphism was basically a radiation-thermal process. Geological and radiation-chemical data demonstrate that alpha-radiation from radioactive elements of the uranium family caused conversion of organic matter into coal. A coalification equation is presented which describes known geological facts and permits making quantitative predictions. Figures 4; references 23: 21 Russian, 2 Western.

12765/9835

CSO: 1841/219

#### TRANSFER OF OIL REFINERY AND PETROCHEMICAL INDUSTRY WORKERS TO NEW WAGE PAYMENT CONDITIONS

Moscow KAUCHUK I REZINA in Russian No 4, Apr 87 pp 42-45

[Article by T. I. Klepikova, USSR Ministry of the Petrochemical Industry]

[Abstract] Most workers in the oil refining and petrochemical industry will be transferred to new payment plans as a result of the decree of the CC CPSU of 17 September 1986 on improvement of the organization's wages. This article describes the new conditions, including premiums for dangerous or harmful work, tariffs for workers not involved directly in production, proficiency pay premiums, pay for foremen, section chiefs, specialists and employees performing the duties of another worker temporarily absent. The order and specific times for transition to the new payment conditions must be determined by each enterprise individually, and may occur simultaneously for the entire enterprise or gradually by individual structural subdivisions or categories of workers.

6508/9835

CSO: 1841/391

RADIATION-TREATED POLYETHYLENES FOR MACHINE-TOOL LUBRICANTS

Moscow KOMMUNIST in Russian 14 Apr 87 p 1

[Article by D. Patyko, correspondent (Gomel)]

[Text] Gamma radiation, oxygen, and ordinary inexpensive polyethylene are all that is needed to produce products which can replace very costly and scarce plastics that are now in production.

This is a conclusion of scientists of the Belorussian Academy of Sciences' Institute of Mechanics of Metal-Polymer Systems, and of the Leningrad affiliate of the Scientific Research Institute of the Rubber Industry. They subjected a polymer material to radiation treatment, after which it became very strong and its friction coefficient proved to be only half that of the previous record-holder, fluoroplastic.

"Gamma rays 'knock' hydrogen atoms out of the polymer and 'sew together' neighboring molecules, making the material hundreds of times as wear-resistant," explained Candidate of Technical Sciences V. Smirnov, one of the authors of this development. "Oxygen in the medium in which the process takes place plays a role, too. Penetrating the material's surface layer with the help of the radiation, the oxygen alters the structure of the polyethylene in such a way that its molecules begin to slide easily against one another. Plastics with the most diverse properties can be obtained from polyethylene by controlling the radiation, oxygen content and other conditions."

Specialists of the Machine-Tool Building Plant imeni Kirov in Gomel were the first to introduce this innovation, with substantial economic benefit. They have also begun to use a variant of this development--a lubricant saturated with particles of a modified polyethylene. Bearing most of the load, these strong plastic beads prevent the lubricant from being forced out of the friction zone and prolong the service life of assemblies. Whereas fluoroplastic packing rings for machine tools cost about 10 rubles each, a similar part made of a modified polyethylene costs no more than 30 kopecks.

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CSO: 1841/378



## LIQUID-CRYSTAL R&D AT CYBERNETICS INSTITUTE

Moscow TRUD in Russian 19 Apr 87 p 2

[Text] Scientists of the Georgian Academy of Sciences' Institute of Cybernetics think that liquid crystals are capable of replacing bulky and energy-intensive systems in the electronics, instrument-building and machine-building industries. Liquid-crystal materials are being developed which employ new chemical components synthesized at this institute. These materials have a considerable number of advantages over earlier ones. Temperature-indicator liquid-crystal films are also being developed here. Such films can be used in diagnosing inflammations in humans, and in the production of medical and household thermometers.

(Two photographs show D. Sikharulidze, head of a laboratory, Candidate of Chemical Sciences Z. Elashvili, and junior science associates D. Khoshtariya and M. Aronishidze examining films; and liquid-crystal optical elements for information processing and display systems.)

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EXPERIENCE IN OPERATING INSTALLATION FOR CONTINUOUS PRELIMINARY DEAERATION OF VISCOSE

Moscow KHIMICHESKIYE VOLOKNA in Russian No 2, Mar Apr 87 (manuscript received 28 Feb 86) pp 50-51

[Article by A. S. Peker, Yu. Ya. Malyugin, A. P. Shcherbakov and L. A. Vasyunkina]

[Abstract] Deaeration is an important stage in preparation of spinning solutions. The total air constant and its distribution by bubble sizes depend on the type of viscose, content of surfactants, time and location of their addition, and nature of the mixing device and filling of container. Two-stage deaeration is used in the production of technical viscose fiber at "Sibvolokno" plant. Preliminary deaeration had a residual pressure of 6.5-13 kPa removes most of the dispersed air. Final deaeration is performed in a fluidized bed at a residual pressure of 0.65-1.3 kPa. In 1986, an experimental preliminary deaeration installation with a capacity of 50 tons per day was tested, consisting of a deaerator with a surface of 30 m<sup>2</sup>, water pump and homogenizer. During testing, variation of the throughput of the installation between 24 and 30 m<sup>3</sup>/hr, had no effect on residual content of air in the viscose. References 2 (Russian).

6508/9835

CSO: 1841/373

## PROPERTIES OF FIBER MATERIALS PROCESSES IN GAS DISCHARGE

Moscow KHIMICHESKIYE VOLOKNA in Russian No 2, Mar Apr 87 (manuscript received 30 Sep 86) pp 51-52

[Article by Yu. I. Mitchenko, A. V. Genis, V. A. Fenin, T. I. Kadontseva and A. S. Chegolya]

[Abstract] The method of treating polymer materials in a gas discharge plasma was used to change the surface relief and certain physical-chemical properties of the surface of the materials. It was found that treatment in a gas discharge converted the surface of the polypropylene fibers to an activated state facilitating an increase in autohesion at the contact point of the fibers. Electron microscope analysis showed that the initial polypropylene fiber specimens had a smooth surface, specific surface  $0.2 \text{ m}^2/\text{g}$ . After gas discharge processing, defects were seen on the surface measuring  $0.1\text{--}0.5 \text{ }\mu\text{m}$ , specific surface increasing to  $0.6 \text{ m}^2/\text{g}$ . Annealing for 1 hour at 373 K smoothed the surface and decreased the specific surface to the initial value. The increase in autohesion resulted from the increased surface area and weakening of intermolecular interactions with an increase in mobility, facilitating mutual diffusion of polymer macromolecules. References 7 (Russian).

6508/9835

CSO: 1841/373

UDC 532.783

## ALL-UNION SYMPOSIUM: LIQUID CRYSTAL POLYMERS

Moscow KHIMICHESKIYE VOLOKNA in Russian No 2, Mar Apr 87 pp 62-63

[Article by B. G. Kulichikhin]

[Abstract] The second All-Union Symposium "Liquid Crystal Polymers", organized by the Scientific Council for High Molecular Weight Compounds, Institute of Petrochemical Synthesis imeni A. V. Topchiyev and "Polimersintez" Scientific-Production Association of the Ministry of the Chemical Industry, was held 13-15 January, 1987 in Suzdal. Some 200 scientists and engineers representing organizations from more than 40 cities of the Soviet Union participated, listening to 10 plenary and 92 demonstration reports on pressing problems related to the investigation and practical utilization of liquid crystal polymers. Topics discussed included: The Present and Future of Liquid Crystal Polymers; Liquid Crystal Systems Based on Linear Polymers; Problems of Synthesis of Thermotropic Aromatic and Aliphatic-Aromatic Polyesters; The Production of High Strength and High Modulus Fibers From Liquid Crystal Solutions and Melts; Dynamic Properties of

Relatively-Dilute Solutions of Mesophasogenic Polymers; The Liquid State of Cellulose and its Derivatives; and, The Practical Utilization of Liquid Crystal Polymers.

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CSO: 1841/373

UDC 678.01.539.412.532.135

PROPERTIES OF RUBBERS BASED ON SKEPT-60 MODIFIED WITH CHLOROCARBOXYLATED POLYPROPYLENE

Moscow KAUCHUK I REZINA in Russian No 4, Apr 87 pp 12-13

[Article by I. G. Movlayev, A. D. Ibragimov, Ya. M. Bulalov and F. V. Mamedov]

[Abstract] Rubber compositions based on SKEPT-60, combined with chloro-carboxylated atactic polypropylene, were produced and analyzed. The rheologic properties of melts were determined as functions of the relationship of components and temperature. The experimental data were used to compute the apparent activation energy of viscous flow of all of the systems studied, containing 5-10% chlorocarboxylated atactic polypropylene. Rubber mixtures were obtained using laboratory rolls and vulcanized for 30 minutes at 153°C. The best physical-mechanical properties were obtained from vulcanizates of compositions containing 5-10 wt. parts chlorocarboxylated atactic polypropylene. Figure 1; references 8 (Russian).

6508/9835

CSO: 1841/391

UDC 541.64:547

PROPERTIES OF FERROCENE-CONTAINING RAW RUBBERS

Moscow KAUCHUK I REZINA in Russian No 4, Apr 87 pp 34-35

[Article by V. I. Gulimov, T. P. Vishnyakova and I. D. Vlasova]

[Abstract] A study is reported of the properties of ferrocene-containing polyisobutylene, polybutadiene and polyisoprene obtained by copolymerization of unsaturated hydrocarbons with  $\alpha$ -cyclopentadienylidene ethylferrocene (CEF). The stability of the ferrocene-containing polymers upon exposure to  $\gamma$ -radiation was judged from the change in their molecular mass upon irradiation of specimens by a  $^{60}\text{Co}$  source at doses of 8 to 250 Mrad. It was found that the introduction of 0.6-3.3 mol.% ferrocene to polyisobutylene, polybutadiene and polyisoprene increased their  $\gamma$ -radiation resistance by

10-30%. During aging of ferrocene-containing polyisoprene, its physical-mechanical characteristics remain practically unchanged. References 8 (Russian).

6508/9835

CSO: 1841/391

UDC 678.029.5:669.695

#### COMPOSITION FOR ACCUMULATION OF HYDROGEN

Moscow KAUCHUK I REZINA in Russian No 4, Apr 87 p 35

[Article by I. D. Khodzhayeva, S. S. Plotkin and S. V. Bogomolov]

[Abstract] Polymer materials containing dispersed metal fillers can accumulate hydrogen in the form of metal hydrides, alloys and intermetallic compounds. This article presents a search for an effective polymer binder for the production of mechanically-strong composites using metal powders which absorb hydrogen. The polymer binder selected was aqueous dispersions of polydienes (latexes). It was found to be desirable to use 10-60% aqueous dispersions of the polymer in a quantity providing a content of polymer in the finished composite of 2-15% (5-40 vol.%). The composite produced is simple to manufacture and can be used in the form of films of varying thicknesses. The technology for manufacturing this composite has been introduced at a plant in the Soviet Union. References 5: 1 Russian, 4 Western.

6508/9835

CSO: 1841/391

UDC 66.012.1:681.121.8

#### FLOW RATE METER FOR MONITORING AND ACCOUNTING FOR MASS OF GRANULATED POLYETHYLENE

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 4, Apr 87 pp 237-239

[Article by M. A. Gatikh, N. M. Solodukho, S. T. Multan and I. V. Lagatskiy]

[Abstract] The Institute of Peat, USSR Academy of Sciences has developed and begun producing at "Plasta" plant in Vilnyus. The RSM-8 mass flow rate meter which measures the mass of granulated polyethylene. The vane-type meter is diagrammed and described. The operation of the meter is based on measurement of the torque generated by polyethylene particles striking the vane in the meter as they flow through it. Its major purpose is to measure



the quantity of granulated polyethylene released from large storage tanks. Figures 2; references 6 (Russian).

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CSO: 1841/380

UDC 541.64:539.216.2

EFFECT OF IONIZING RADIATION ON SELECTIVE PROPERTIES OF POLYMERIC MEMBRANES

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 59, No 11, Nov 86  
(manuscript received 6 Feb 85) pp 2587-2588

[Article by L. L. Kozlov, V. N. Khabarov and A. V. Novopashin, Moscow  
Institute of Petrochemical and Gas Industries imeni I. M. Gubkin]

[Abstract] Ionizing radiation acts on polymeric membrane films altering their gas permeability and thus affecting the selectivity of gas separation. Such alteration should not damage the other physical chemical characteristics of the film. It has been shown previously that relatively small doses of radiation resulted in marked changes in gas permeability of polymer films while increasing their strength characteristics. In the present work results are presented on a study of the effects of Co-60 gamma-radiation at 0.03-0.1 Mr on the gas permeability of polyvinyl chloride and polyamide films by previously described methods for 10 gas mixtures such as carbon dioxide/oxygen, hydrogen/oxygen, oxygen/nitrogen and helium mixed with hydrogen, nitrogen and oxygen at temperatures ranging from 293-325 K. Radiation doubled the gas separation coefficient of PVC for oxygen/hydrogen, hydrogen/carbon dioxide and hydrogen/helium mixtures. Raising the temperature results in a drop of gas separation as a rule. Results of these investigations are useful to both membrane technology and food packaging. References 7 (Russian).

12765/9835  
CSO: 1841/215

## POLYMERIZATION OF ADAMANTANE VAPORS IN ELECTRICAL DISCHARGE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 291, No 4, Dec 86  
(manuscript received 28 Jan 86) pp 917-919

[Article by D. V. Fedoseyev, A. V. Lavrentyev and I. G. Varshavskaya,  
Institute of Physical Chemistry, USSR Academy of Sciences, Moscow]

[Abstract] The present work was undertaken to prepare solid coatings from adamantane whose molecules are similar to fragments of elemental diamond nuclei. Experiments were conducted with adamantane vapors or their mixtures with hydrogen in a quartz reactor between two electrodes which produced a glow discharge from alternating current. Adamantane ionization took place at the positive post and then deposited on a substrate at a temperature below that of adamantane decomposition. Quartz and various metals served as substrates. The resulting solid coatings had colors ranging from yellow to dark brown, depending on the temperature. Thickness of the coatings decreased with temperature and at 700 deg became gray, possibly due to graphitization. Microdiffraction tests showed that the coatings cannot be described as either diamond or diamond-like, but rather like hydrocarbon coatings which contain stretched out fragments of diamond structure. Micro-hardness of the initial quartz was 980 kg/sq mm and 1290 kg/sq mm after being coated; similar readings for molybdenum were 245 (initial) and 515 after coating. These readings refer to the system, and not to the coating alone, as the imprint depth of the hardness indicator exceeded the thickness of the coating. Electrical conductivity tests were also made on the coatings. Long term tests on the resistance of the coatings to low temperature air plasma of a glow discharge showed that the etching rate of the coatings exceed that of diamond by 10 times, but is less than that of graphite. After heating in air, the coating burns without leaving any residue. Figures 2; references 5: 4 Russian, 1 Western.

12765/9835

CSO: 1841/210

## DISSOLUTION OF HEMOSTATIC Ca-ALGINATE FIBERS IN AQUEOUS SOLUTIONS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 29, No 4, Apr 87  
(manuscript received 9 Aug 85) pp 692-697

[Article by L. L. Razumova, A. A. Veretennikova, G. Ye. Zaikov, S. L. Davydova, L. D. Narkovich, T. N. Kalinina, Ye. L. Illarionova and L. A. Volf, Institutes of Chemical Physics and of Petrochemical Synthesis imeni A. V. Topchiyeva, USSR Academy of Sciences; Institute of Textile and Light Industry imeni S. M. Kirov]

[Abstract] A study was conducted on rate of Ca release and fiber dissolution from Ca-alginate preparations intended for use as hemostatic dressings. A combination of atomic absorption spectroscopy, x-ray diffraction, and gravimetric techniques were used to monitor the dissolution process in water, physiologic saline, normal Ringer's solution, and Ringer's solution supplemented with excess  $\text{Ca}^{2+}$ . The data showed that in the initial 10 sec of incubation at 37°C, ca. 10% of the weight was lost, with minimal if any subsequent changes in weight. Concomitantly, the initial 10 sec of incubation were also accompanied by release of about 20-50% of the Ca concentration. The losses of calcium were greatest in water and physiological saline, less in normal Ringer's, and the least in Ringer's-supplement-with  $\text{Ca}^{2+}$ . Isometric extension of the alginate fibers limited the fiber loss from the samples in a manner analogous to that reported for other hydrophilic substances. Figures 3; references 22: 11 Russian, 11 Western.

12172/9835  
CSO: 1841/385

## EFFECTS OF THERMAL TREATMENT ON ELECTRIC FLUCTUATIONS IN POLYMERIC SYSTEMS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 29, No 4, Apr 87  
(manuscript received 23 Sep 85) pp 807-811

[Article by Yu. V. Zelenev and V. A. Ivanovskiy, Moscow Textile Institute imeni A. N. Kosygin; Tambov Higher School--uchilishche--of Military Aviation Engineering]

[Abstract] Since thermal processing remains one of the most effective methods of altering the supramolecular structure of polymers, a detailed analysis was conducted on the effects of thermal treatment on electric fluctuations in polymethyl methacrylate (PMMA). Measurement of the intensity of electric fluctuations in noncrystalline PMMA showed a maximum in fluctuations at the temperature corresponding to alpha-relaxation processes. On annealing, the maximum temperature of fluctuations was displaced

to a higher level, while quenching led to displacement of the maximum to a lower temperature. Quenching also displaced the temperature of beta-relaxation processes to a higher temperature range and altered the nature of the process, which again found reflection in changes in the electrical fluctuations. These observations point to the utility of using changes in electrical fluctuation in analyzing fine aspects of molecular mobility. Figures 5; references 9 (Russian).

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CSO: 1841/385

UDC 541.64:537.7

#### PREDICTION OF PHYSICAL CHARACTERISTICS OF POLYMERS FROM ELECTRICAL FLUCTUATIONS OVER WIDE TEMPERATURE RANGE

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 29, No 4, Apr 87 (manuscript received 23 Sep 85) pp 812-817

[Article by Yu. V. Zeleney and V. A. Ivanovskiy, Moscow Textile Institute imeni A. N. Kosygin; Tambov Higher School--uchilishche--of Military Aviation Engineering]

[Abstract] A mathematical rationale is provided for the relationship between thermal expansion of polymers and electrical fluctuations. Changes in the voltage at viscoelastic transition temperatures and the initial stages of chemical relaxation were found to be in excellent agreement with experimental dilatometric results. On this basis, the method was applied to PVC and natural rubber. Again, the nondestructive method here proposed yielded physical information in good agreement with the results derived by conventional methods. Figures 6; references 15: 13 Russian, 2 Western.

12172/9835  
CSO: 1841/385

UDC 678.048:678.4.06

#### MECHANIZATION OF DIFFUSION MODIFICATION PROCESS OF RUBBER PRODUCTS

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 3, Mar 87 pp 17-18

[Article by Engineers Ye. I. Gerashchenko and Ye. V. Prokazova]

[Abstract] Diffusion saturation of rubber products with stabilizers significantly improves their resistance to various types of aging. One promising trend in diffusion modification is the use of compositions based

on organosilicon polymers. Application of this method is limited by technological factors such as the need to use manual labor to apply and remove polymer coatings. Present techniques also do not allow processing at high temperatures to increase productivity. An installation has now been developed for dynamic modification of rubber products, equipped with a drive to rotate a drum containing the saturating composition and a heater with a temperature regulation. The installation is diagrammed and described. It is intended for diffusion modification of rubber products which are bodies of rotation, such as rings and collars. Figures 2; references 3 (Russian).

6508/9835

CSO: 1841/319



UDC 541.18.053

## DISINTEGRATION OF DEFORMED SILICON-OXYGEN BONDS UPON ELECTRON EXCITATION OF MECHANICALLY ACTIVATED SILICON DIOXIDE

Moscow KHIMICHESKAYA FIZIKA in Russian Vol 6, No 2, Feb 87  
(manuscript received 18 Apr 86) pp 188-194

[Article by I. K. Pavlychev, A. A. Bobyshev and P. Yu. Butyagin, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] Amorphous silicon dioxide powders with specific surface  $S=1-1.5 \text{ m}^2/\text{g}$  and aerosil with  $S=120 \text{ m}^2/\text{g}$  were annealed in oxygen ( $p=10^3 \text{ Pa}$ ) and in a vacuum ( $p=10^{-3} \text{ Pa}$ ) for about 50 hours at  $1100^\circ \text{K}$ , mechanically treated in a quartz micromixer and irradiated and the concentration of mechanical and radiation defects was determined by electronic paramagnetic resonance and chemisorption findings. The basic process of radiation damage of the mechanically-disordered silicon dioxide was homolytic disintegration of the deformed silicon-oxygen bond with a very high radiation yield of 1-4. These findings showed that the absorption of gamma-irradiation proceeds throughout the material with subsequent migration of the primary excitations to the surface. In contrast to this, formally calculated radiation yield of formation of surface radical  $\text{Si}^*$  and  $\text{SiO}^*$  would be about 400. Disintegration of the electron-excited deformed bonds was accompanied by migration of the radical states and their partial destruction and stabilization of equal amounts of  $\text{Si}^*$  and  $\text{SiO}^*$ . Mechanical disordering of the silicon dioxide permitted migration and further stabilization of products of disintegration of the deformed bonds in the form of  $\text{Si}^*$  and  $\text{SiO}^*$  radicals. Figures 3; references 11: 9 Russian, 2 Western.

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CSO: 1841/276

THERMAL EFFECTS DURING ABSORPTION AND INTENSIFICATION OF CO<sub>2</sub>-LASER EMISSION IN CO<sub>2</sub>-N<sub>2</sub>-O<sub>2</sub>-H<sub>2</sub>O MIXTURES

Moscow KHIMICHESKAYA FIZIKA in Russian Vol 6, No 2, Feb 87  
(manuscript received 2 Jan 86) pp 204-212

[Article by A. A. Sorokin and A. M. Starik]

[Abstract] An analysis of the effect of absorption of laser radiation ( $\lambda=9.4-10.4 \mu\text{m}$ ) by water vapors on the dynamics of change of advancing temperatures in a CO<sub>2</sub>-N<sub>2</sub>-O<sub>2</sub>-H<sub>2</sub>O mixture is described and discussed. It was found to be necessary to consider not only absorption of radiation from  $\lambda=9.4-10.6 \mu\text{m}$  by the water vapors but also the finite time of thermalization of energy absorbed by the H<sub>2</sub>O molecules, in order to avoid errors. Figures 6; references 13: 10 Russian, 3 Western.

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REDUCTION OF METAL OXIDES (Fe<sub>2</sub>O<sub>3</sub>, NiO and WO<sub>3</sub>) BY HYDROGEN IN ACCELERATED ELECTRONS BEAM

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIYE NAUKI in Russian Vol 2, No 1, Jan 87 (manuscript received 15 Jul 85) pp 36-41

[Article by S. V. Rusakov, V. L. Auslender, I. G. Bochkarev, A. P. Voronin, O. S. Gribkov, N. Z. Lyakhov, A. N. Modestov and V. A. Polyakov, Institute of Solid Body Chemistry and Treatment of Mineral Raw Material, Siberian Department, USSR Academy of Sciences; Institute of Nuclear Physics, SD, USSR AS, Novosibirsk]

[Abstract] A study of the effect of an electron beam, on the kinetics of reduction of Fe<sub>2</sub>O<sub>3</sub>, NiO and WO<sub>3</sub> in hydrogen, used a high-frequency (120 MHz), pulsed (0.5 ms) accelerator. The beam of accelerated electrons (energy 1.7 MeV) in the 280-700°C range entered the reactor through thin metal foil, cooled by compressed air, and heated the reduced oxide sample. Kinetic data of reduction occurring during radiation heating were compared with data obtained for thermal heating. Significant acceleration of reduction occurred during radiation heating. The acceleration was attributed to electron activation of the solid reagent. Figures 3; references 14: 11 Russian, 3 Western.

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CALCULATION OF ISOTOPIC SELECTIVITY OF BROMINE MOLECULE EXCITATION UNDER ACTION OF SECOND HARMONICS IRRADIATION OF YAG: Nd<sup>3+</sup>-LASER

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA 2, KHIMIYA in Russian Vol 27, No 6, Nov Dec 86 (manuscript received 1 Aug 85) pp 543-546

[Article by V. A. Musikhin, I. A. Semiokhin and Ye. A. Sokolova, Chair of Physical Chemistry]

[Abstract] In experiments on isotope separation by laser, the question arises of what selectivity does the first stage of the process, that of bromine molecule excitation, provide. The problem is further complicated by the fact that in the region of second harmonics irradiation by a neodymium laser, a convenient instrument for bromine molecule excitation, the spectrum is the result of the super-imposition of several electron transitions of each isotope variety. Recently, however, reliable data have appeared on spectral parameters of the bromine molecule which make it possible to compute the absorption spectra of the bromine molecule at the desired frequency range. This computed spectra agreed with experimental data, and a possibility arose for computing expected selectivity of bromine excitation for a given isotope at a given frequency of laser radiation under pre-set experimental conditions (pressure, temperature) with allowance for line broadening due to shock and doppler effects. In the present work, results are presented on computing spectra selectivity under laser excitation of bromine molecules at various laser line frequencies, temperatures and pressures of molecular bromine. A clear relationship was detected between bromine molecule excitation selectivity and the above parameters. It is demonstrated that the proposed computation method allows selection of optimal conditions for laser experiments on excitation of other di-atomic molecules having isotopic variety. Figures 2; references 3: 2 Russian, 1 Western.

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## STUDY OF MASS SPECTRA OF SILANE DECOMPOSITION PRODUCTS IN PLASMA OF HF-DISCHARGE

Moscow KHIMIYA VYSOKIKH ENERGII in Russian Vol 21, No 1, Jan Feb 87  
(manuscript received 14 Jul 85) pp 75-78

[Article by A. A. Andreyev, Yu. A. Ivanov, A. I. Kosarev and I. Stukhlik, Physico-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences; Institute of Petrochemical Synthesis imeni A. V. Topchiyev, USSR Academy of Sciences; Physical Institute, Czechoslovakian Academy of Sciences]

[Abstract] The mechanisms of plasma-chemical deposition of amorphous silica (a-Si:H) films are not yet clear owing to the lack of experimental data on the gas phase and heterogeneous reactions that take place during this process. One problem in particular is studying the correlation between parameters in the electron composition of the plasma and the gas phase products. In the present work, a study was made of the mass spectra of a high-frequency discharge plasma in respect to the U/P parameter at constant gas residence time in the discharge zone, where U = amplitude of HF discharge between the electrodes, P = reactor pressure. It was demonstrated that at U/P = 2 v/Pa the a-Si:H film growth rate is maximum, and that the yield of products from the di- and tri-silane groups is higher than that in the region of high U/P values. Figure 1; references 6: 3 Russian, 3 Western.

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## COMPLEX FORMATION OF URANYL ION WITH CERTAIN AMINOPOLYCARBOXYLIC ACIDS BY DERIVATIVE SPECTROPHOTOMETRY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 291, No 4, Dec 86  
(manuscript received 6 Jan 86) pp 898-901

[Article by V. A. Perfilyev, V. T. Mishchenko and N. S. Poluektov, academician UkSSR Academy of Sciences, Physical Chemical Institute imeni A. V. Bogatskiy, UkSSR Academy of Sciences, Odessa]

[Abstract] During complex formation with aminopolycarboxylic acids, the uranyl ion displays several special features in comparison to other double charged cations, which are related to its large size. In a previous study of uranyl ion complex formation with ethylenediaminetetraacetic acid in aqueous solutions, derivative spectrophotometry was shown to be capable of detailing the absorption bands of the uranyl ion. In the present work, data are presented on the complex formation of the uranyl ion with other aminopolycarboxylic acids having a different number of reactive groups in

their composition: iminodiacetic, nitrilotriacetic and diethylenetriamine-pentaacetic acid. Absorption spectra and their second derivatives for the uranyl-aqua ion and its other complexes show that the latter has improved broadening of components making it possible to isolate band series for magnetic and fluorescent electron-vibration levels. A comparison of derivative spectra for various complexes demonstrates that the magnitudes of the most intense bands of the magnetic and fluorescent electron-vibrational levels of the uranyl ion are not identical. An unequal shifting of absorption band maxima to the long wave region of the spectrum was observed during uranyl ion complex formation with various aminopolycarboxylic acids. Comparison of second derivative band intensities of fluorescent and magnetic electron-vibrational levels of the uranyl ion makes it possible to judge the symmetry of its immediate surroundings in solutions of various complex compounds with aminopolycarboxylic acids. Figures 3; references 7; 6 Russian, 1 Western.

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RADIATION CARBONIZATION OF CELLULOSE, WOOD AND LIGNIN IN PRESENCE OF AIR

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA 2, KHIMIYA in Russian  
Vol 27, No 6, Nov Dec 86 (manuscript received 2 Aug 85) pp 568-571

[Article by A. V. Rudnev, L. A. Loginova and A. I. Valter, Chair of  
Electrochemistry]

[Abstract] Plant residues containing cellulose and lignin were converted into coal over geological time, the genetic varieties of the coal being a function of the chemical composition of the plant matter and the natural conditions of coal formation. During the evolutionary process this matter was subjected to various factors such as temperature, pressure and ionizing radiation from radioactive isotopes of uranium, thorium and calcium-40. This latter factor must be taken into account when considering the evolution of organic matter in nature, as supported by many experimental facts. In the present work a study was made of radiation process of wood and its cellulose and lignin components in the presence of air by the EPR method and element analysis. The results are discussed from the point of view of dehydration of radicals formed during the radiation process and their oxidation with air oxygen. Figures 3; references 9: 4 Russian, 5 Western.

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CSO: 1841/235

EXCHANGE CAPABILITY OF SULFATE LIGNIN IN EFFLUENT OF CELLULOSE-PAPER INDUSTRY

Kiev KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 9, No 2, Mar Apr 87  
(manuscript received 24 Oct 85) pp 124-126

[Article by V. V. Tulyupa and T. V. Knyazkova, Institute of Colloid Chemistry and Water Chemistry, imeni A. V. Dumanskiy, UkSSR Academy of Sciences, Kiev]

[Abstract] Sulfate lignin is an effective membrane-forming substance used in production of dynamic membranes (DM). The properties of DM and membrane modifications are related to acidity of the lignin; the content of acid groups in lignin varies widely (from 0.15 to 5.85 mg-eq/g). There are a number of methods used in determining acid groups in lignin, none of them are easy. In this study reverse titration was used to determine complete exchange capacity of sulfate lignin. The test sample was shaken with NaOH solution for 4-6 hrs to achieve complete solution of the particles; then it was titrated potentiometrically with HCl. Analysis of the titration curves led to the conclusion that, in alkaline pH, lignin is in a molecularly-dispersed state and beyond the coagulation threshold--in the form of stable aggregates. Maximum values of the complete exchange capacity of the investigated sulfate lignin is at pH 11 and amounts to 4.1-5.1 mg-eq/g. This value should be used in analyzing the behavior of sulfate lignin in membrane filtration of lignin containing effluent and in other purification methods. Figures 2; references 8: 7 Russian, 1 Western.

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